(Mineral and Metallic Series, No. 5)

THE

AGRICULTURAL LEDGER.

1896—No. 1.

REH

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. VI, Pt I., R. 67-70*]

THE DISTRIBUTION OF THE SALTS IN ALKALI SOILS.

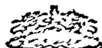
BY E. W. HILGARD AND R. H. LOUGHRIDGE. *Reprinted from Bulletin No. 108, August 1895. University of California, Agricultural Experiment Station, Berkeley, Cal.*

Other DICTIONARY articles that may be consulted:

Calotropis gigantea, *Vol. II*, C. 190.
Sand binding plants, *Vol. VI, Pt. II.*, S. 774.
Tamarix, *Vol. VI, Pt. III*, T. 51-82.

also

Agricultural Ledger, Nos. 12 and 13 of 1893.



CALCUTTA
OFFICE OF THE SUPERINTENDENT, GOVERNMENT
1896

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AGRICULTURAL LEDGER.

1896—No. 1.

REH.

[*Dictionary of Economic Products, Vol VI, Pt I*, R. 67 70]

THE DISTRIBUTION OF THE SALTS IN ALKALI SOILS

By E W HILGARD *and* R H LOUGHRIDGE.

As time progresses the importance of the alkali *question*, *i e*, of dealing successfully with the cultivation of lands more or less impregnated with soluble mineral salts becomes more and more obvious It is to be greatly regretted that the frequent mistaken efforts of land-owners to suppress, or a ... the selling value of thei ... ing with an intrinsicall ... circumstance, we bear ... in finding that, unexpec ... culture experiment stat ... ject to the difficulties ... since we are thus enabled to study the problem independently of any private interests Importance of the alkali question.

The culture experiment station near the town of Tulare, originally intended to represent the upper San Joaquin Valley at large, has thus, instead, become the station for the study of the alkali problem in all its phases from the mildest to the worst Until this problem is solved, no certain conclusions for the region at large can be drawn from the cultural results observed there, since we now know that all the vegetation on the Station grounds is under more or less stress from the alkali in the soil If h ... influence, as we h ... the San Joaquin V ... west of the Rocky ...

NATURAL CONDITION OF THE LAND

For an understanding of ... here, that in their *natural* ... several miles around, as in ... ley and the State show on ... these spots, during the spring months, the country is covered with a

R. 67-70.

REH	The Distribution of the Salts

luxuriant growth of native (largely annual) herbaceous plants, many being showy flowers and affording a most attractive sight, also proving beyond question the great inherent fertility of the land As the season advances, from April to June, these plants go to seed or dry up, leaving the land more or less bare, or with only a sparse growth of hardy, drought resisting, partially perennial plants There is not, in ordinary seasons any perceptible increase or decrease in the area of the interspersed alkali spots

Behaviour without Irrigation

When such land is put under cultivation *without* irrigation it will in years of unusual moisture bring very heavy crops of grain, which easily make up for at least *one* other season of almost total failure when the rainfall is light or unfavourably distributed It is this 'fighting chance' of a highly remunerative crop that has in so many cases induced the investment of entire fortunes in such ventures, frequently with a total loss and financial ruin as the result, a kind of agricultural gambling little better in itself and with as many chances against success, as that at the faro table but now happily almost a thing of the past

Behaviour under Irrigation

Under Irrigation

With the advent of the irrigation ditch the heavy grain crop becomes for a few years a matter of certainty Then there is a gradual change for the worse First it is noticed that the alkali spots increase their area outward, often merging neighbouring small spots into one large one Then new ones begin to appear, at first "no larger than a man's hand," but enlarging each year, and finally often so cutting up and reducing [illegible]

"Rise of alkali

[illegible]

superficial observers

The Question to be Solved

Amount of salts contained in soil

Then arose the question, 'How much of these salts does the soil contain, or where do they come from?" If it could be shown that the soil, subsoil and substrata [illegible]

Alkali salts contained in bottom waters

[illegible]

Position of salts in soil

[illegible] are known to be formed in *all* soils in consequence of weathering, and that it contains *all* the ingredients *useful*, as well as those *useless*, to plant growth, substances which in rainy countries, are currently leached out and carried into the country drainage and finally into the ocean, but which in regions of scanty rainfall remain in the soil mass

R, 67-70.

in Alkali Soils (*Hilgard and Loughridge*) REH

We are thus led to the vitally important conclusion *that the amount of the salts in these lands is but limited* and that if once removed, or rendered innocuous to crops in some other way, it will take thousands of years in the future, as in the past before another such accumulation can

Distribution of salts

EXAMINATION OF SOIL PROFILES AND REPRESENTATION OF RESULTS

Results Mode of procedure

auger) so that each represented a vertical column of three inches of soil; continuing thus to the depth of two to four feet Each of these samples was then leached of its salts, and every leaching analyzed separately It was at first attempted to leach only the average of each foot, but this

Explanation of diagrams.

The predominance of carbonate of soda seen in these diagrams shows at once that the Tulare alkali is very "black," so that the use of gypsum to change the carbonate into sulphate is the first thing needful in attempt-

R. 67-70.

REH	The Distribution of the Salts

Explanation of Diagrams.

ing any reclamation or preventive measures But aside from this the diagrams suggest very instructively, the explanation of many points not well understood heretofore

EFFECT OF THE RAINFALL

RAINFALL

Depth to which salts may be washed

It is well known to residents that in Tulare and northern Kern Coun

Evaporation of soil moisture

Position in the soil of salt.

Influences of Crops

ter to the ... or prevent the rise of the alkali Hence a crop of alfalfa once established may flourish for years on ground that so soon as it is left bare during the dr...

prove altogether

Decrease of salts

From about

decrease of the

reduced to little more than is shown at the end of the first foot from the surface

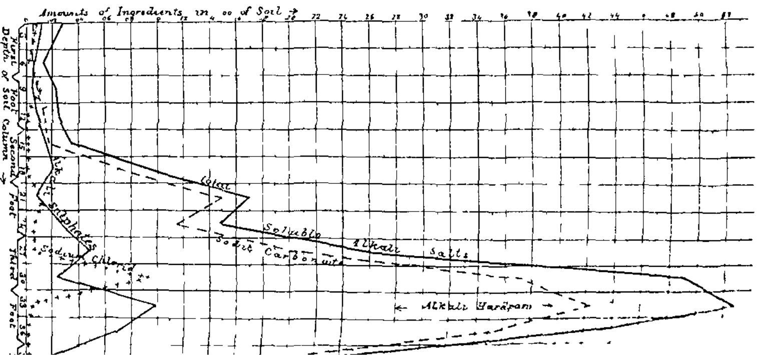
Those familiar with the black alkali lands ... Valley

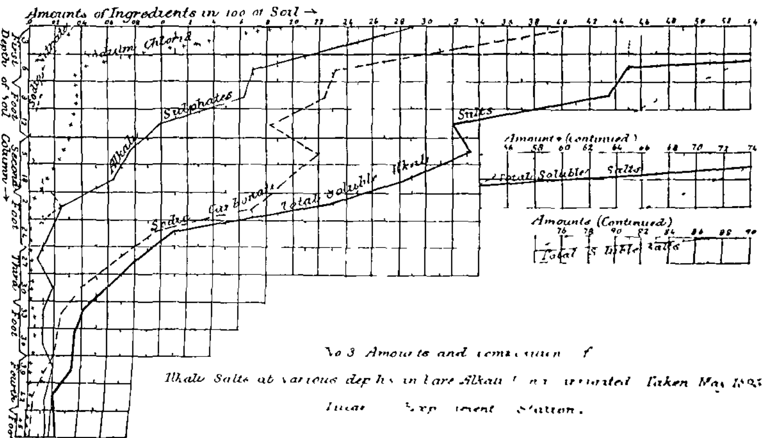
punchir

Bulk of Salts near surface

we see thus demonstrated beyond any possible cavil the correctness of the conclusion we have previously drawn from the examination of the bottom waters ... that *the bulk of the alkali salts is even in natural alkali lands accumulated within easy reach of the surface and of underdrains*, and that, *if this accumulation is once removed no more or at least*

R, 67-70.


Amounts of Ingredients in 100 of Soil →
Total
Soluble
Alkali
Salts
Sodium Carbonate
Alkali Sulphates
Sodium Chlorid
← Alkali Hardpan →
3
6
9
12
15
18
21
24
27
30
33
36
First Foot
Second Foot
Third Foot
Depth of Soil Column →



No 3 Amounts and composition of
Alkali Salts at various depths in Bare Alkali … Taken May 189…
… Experiment Station.

not enough to do any harm, will come from below This points to *underdrainage* as the ready and complete corrective of all alkali, as has been long ago recommended by us. Under drainage.

But it does not therefore follow that the indiscriminate use of underdrainage is to be recommended, since, as we have abundantly shown, enormous amounts of valuable soil ingredients would thus run to waste In the majority of cases other means, presently to be referred to, will accomplish the reclamation

Effects of Irrigation

IRRIGATION, Effects of.

Let us now see what effect irrigation, or the establishment of leaky ditches in a pervious soil, will produce in land circumstanced as shown in Plate I

As regards the latter case, any one can see for himself that as the ditch water, filling up the land from below upward, comes in contact with the alkali sodden subsoil or hardpan layer, it will dissolve the salts and carry them up toward the surface Evaporation from the moistened surface will then go on all the year to a greater or less extent, and the alkali will keep steadily moving upward, until, in the course of a few years, the maximum will be found, not three feet below, but [illegible] "rise of the alkali," very [illegible] outcome is graphically [illegible]

[illegible] ginally similar to that [illegible] for four or five years, and, quite lately, has also been influenced by a neighbouring leaky ditch, outside of the Station inclosure Here we see that the alkali has moved bodily upward, and has accumulated near and at the surface to such a degree that any useful growth of ordinary crops has become impossible Seeds sown (except those of salt bushes) are quickly corroded or "rotted" by such alkali as this, and fail to sprout, anything set out, ready-grown, may live while the rains last, but will be promptly killed by the corrosion of the root-crown, or lower end of the stem, from the effect of the strong solution formed around it whenever a light rain or heavy dew falls, even if the root should be able to resist the action of the alkali within the soil itself

Why surface irrigation produces same result as rise of the bottom water

It is not quite so easy to understand why surface irrigation should produce the same general result as the rise of the bottom water from below; and yet a little consideration readily explains it Under irrigation the land receives many times more water than in its natural condition, but rarely enough to leach the alkali salts into the country drainage, even if the impervious hardpan layer did not stand in the way Practically all this irrigation water therefore ultimately evaporates in the course of the year As it penetrates the soil to a greater depth than the natural rainfall ever goes, it gradually dissolves the alkali salts in the subsoil, and in the progress of its evaporation throughout the season, carries them with it toward the surface, instead of leaving most of them accumulated at between two and three feet depth, as in the natural state In the course of time, especially in orchards where the soil remains bare and therefore exposed to evaporation throughout the season, the accumulation near the surface becomes so great as to injure even the bark of full-grown trees and vines, while

REH.	The Distribution of the Salts

"Black" alkali or carbonate of soda

"Alkali ponds"

ordinary herbaceous vegetation becomes impossible If the alkali should be of the "black" kind—*i e*, carbonate of soda—the soil will soon begin to settle, and puddles of inky water will remain for some time after rains or irrigation, sometimes forming permanent "alkali ponds," with a bottom of tough, impervious hardpan, of the same nature as that shown in Plate I

That these worst effects can be suppressed by the conversion of "black" alkali into "white" by means of gypsum, has been already sufficiently explained in former publications The "white" or neutral alkali is many times less injurious than the "black," which is so corrosive that it dissolves not only the humus of the soil, but also the bark of plants, always excepting the wonderful "salt bushes" and their kind But there are limits, varying for different plants, beyond which even the "white" alkali becomes incompatible with cultivation, so that its accumulation near the

Effects of Cropping

Plate 2 shows the effect of a growing crop on the same land as that in Plate 3 within the Station grounds the samples on the two plates having been taken within ten feet of each other But a heavy dressing of

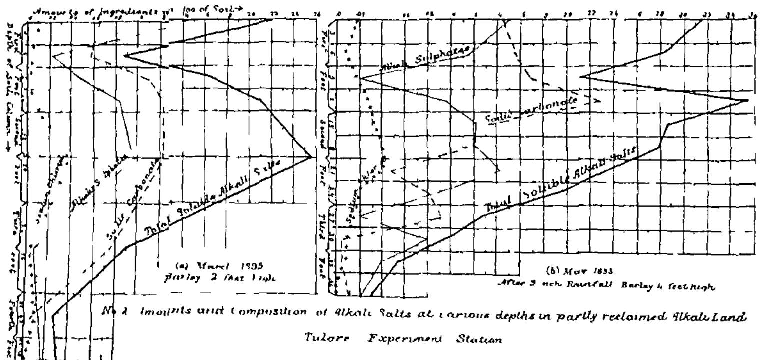
Alfalfa, beneficial tendency of

Counteracting Evaporation

EVAPORATION

From what has been said it is obvious that since *evaporation from the soil surface is the cause of any "rise of the alkali,"* one of the chief preventive measures must be *the reduction of surface evaporation to the lowest possible point* This can be done either by mulching or, less effectually, by shading

R. 67-70.



No 2 Amounts and Composition of Alkali Salts at various depths in partly reclaimed Alkali Land

Tulare Experiment Station

REH. | The Distribution of the Salts in Alkali Soils

When gypsum should be applied

followed by irrigation, unless the rainy season can be relied upon to perform the service before seeding time The smaller the seed to be sown the more important is this precaution, beans, peas or maize may remain unharmed where alfalfa, or other clover s eds, as well as those of meadow and pasture grasses, would perish either before or during germination

One additional point should be emphasized here. It will be seen from the curve lines represent ng the individual salts—common and Glauber's salt, and sal soda—that the latter is proportionally most abundant in the clay hardpan (Plate 1), where it forms from 80 to over 90 per cent of the whole, while near the surface, in the very same bore-hole it forms about 23 per cent only This is due to the moisture and want of aeration in the subsoil, acting in a manner not easily explained in a popular way. But it may be taken for granted that whenever an alkali soil is subjected to the action of stagnant water, or of abundant moisture without aeration, the formation of black alkali will take place This is the reason why the latter is most commonly found in low, moist ground, and in close, heavy soils, while on the higher ground adjacent the white salts alone may prevail The "swamping" of alkali lands is thus seen to be doubly pernicious, and the leaky ditches which cause it should, for this reason alone, be considered a public nuisance.

G I. C P O No 89. R & A —23-7 96 —2,100—H R.

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THE

AGRICULTURAL LEDGER.

1896—No. 3.

HORSES, ASSES AND MULES.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. IV., H. 414-36.*]

NOTES ON CHINESE MULES.

Notes by VETERINARY CAPTAIN G. H EVANS, A.V.D., *Superintendent, Civil Veterinary Department, Burma.*

Other PAPERS that may be consulted:

Agricultural Ledger, 1893, Nos. 16 and 19; 1894, Nos. 12 and 14; 1895, Nos 7, 10, 12, 19, 22, 24, and 25



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(Veterinary Series, No. 18.)

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HORSES, ASSES AND MULES.

[*Dictionary of Economic Products, Vol IV., H 414 36*]

NOTES ON CHINESE MULES

By VETERINARY CAPTAIN G H. EVANS, A.V D, *Superintendent, Civil Veterinary Department, Burma.*

In the following notes Chinese names are generally given and the corresponding Burmese name is sometimes entered in brackets Vowels have their continental value Distance between places is roughly indicated by the number of days journey from one to the other

Names Transliteration.

There are two separate Mule-breeding areas

Breeding in Shansisein

1 In the jurisdiction of the Zon-du or Chief Commissionership of Shansisein about one month's journey north west of Yi nan sein. Donkey stallions are here crossed with mares which as well as the horses measure from 13 hands They and the mules bred, which measure from 12 to 13 hands or more, are shorter in the back than the average Burman pony

These mules fetch R300 to R500 and are used for riding by Chinese officials and merchants

muni-
fetch-
seen

Breeding in Yinansein.

2 The breeding of transport mules as used in Burma, is carried on in the division of the Sitao or Commissioner of Tali, who is directly subordinate to the Zon du, Chief Commissioner of the Yinansein province.

Districts.

Immediately under this Sitao are, among others, the Fujwan or Deputy Commissioners, stationed at the following places :—

MULE BREEDING AREAS.

four days east-north-east from Yōnpyin, and 9 Shagwan, two days east from No 4 Yangpyi

Localities from which mules for Burma are drawn

The mules used in Burma come mainly from No 5 Sheu Dyen township, some few from No 6 Shayan township, and a fair number ... owners to ... steadily in

Purpose for which employed

... employed,

1 —Salt : Distributing from the Chinese Government Factory north of Tali-fu 5,000

2 —Tea . Distributing from Sze mao, Puerh, Shan States ...

... 10,000

... 2,000

... thence in the Shan States . . . 1,000

5 —Burma Government 2,000

6 —Miscellaneous internal Chinese trade 10,000

Total number available for work, say . . 30,000

Working Season

The working season extends from November to April inclusive, the rains being heavier in this part of China than in Burma and lasting about the same period Arrangements for hiring are made in October, and the mules get back to their homes about May

Owners or Kawtoks.

Kawtoks

... s In ... this ... awtok,

Classification

2 Those who purchase mules

The latter may be sub divided, *viz*, Managing Kawtoks who accompany their own mules, and others which may have been entrusted to them. Owning Kawtoks who hand their animals over to a manager for the working season and do not go with caravans Lawbans are the middlemen between Kawtoks and hirers the Chinese Lawban is a term applicable to any merchant or contractor on a large scale, and is also used by the Burmese A Lawban will make necessary advances in China to Kawtoks at the beginning of the season and promise a certain monthly payment

Settlement of disputes.

Disputes are settled by the arbitration of local magnates, and are seldom referred to Courts, which only open on certain days, and, as a rule, only adjudicate on cases of exceptional difficulty or importance

Breeding.

Breeding

The donkey mares are never crossed with pony stallions, they are kept to breed donkeys. The best donkey stallions are imported from Shansisein and fetch prices ranging to R300, they are stronger and

MULE-BREEDING

larger than those bred in Yunnan, and cover mares without assistance They cover annually from 40 to 50 mares, and are only employed for stud purposes between the ages of four and ten The fee for covering private mares is R5 The breeding season is during April and May In Yunnan the stallions receive assistance, some breeders after the ... ing the mare a shock, ... corresponds to the ... water into the ear ... beans, it is damped ... mares and mules get ... e day the mares are ... re under charge of a driver, they are driven in at night If a stallion should cover a mare of another owner, the driver reports the matter and a fee is charged No fences exist, except round cultivation

Feeding

The number of foals obtained is usually twenty to thirty out of fifty mares covered Pony mares are kept for further breeding Colts with few exceptions are gelded and, when old enough, are used with the mules ...

Number of foals

... A mule is consid ... during this period ... s fetch long prices ... R10 a head more

Attendants and their wages.

About eight men are required to take charge of fifty animals when at work thirteen or fourteen are wanted to look after the same number These men are always provided by the owner, who engages extra hands for the open season

Drivers etc

R4 for an inexperienced hand, to R15 for a man who understands shoeing and treatment of sick animals Owners provide food, cheroots, etc, this amounts to about R7 8 per mensem in Burma, and about R3 less in China if engaged for a long period they receive a suit of clothes every six months The drivers usually settle when the ...

Wages

Adjustment of accounts

from R40 to R60, a good deal depending on the number of deaths

Kawtoks frequently visit trade centres like Bhamo, and take on contracts themselves without the intervention of a Lawban, rates as low as R17 to R19 are sometimes taken

Engagement of mules for Burma

Treatment of Ailments.

Musk is a favorite remedy a decoction is given in cases of colic, it is also used to inject into abscesses and is used as a powerful astringent.

Med cines.

The Chinese have another way of treating colic, the sick animal is ...

HORSES and MULES	Notes on Chinese Mules

MULE DRIVERS

Use of Opium.

Use of Opium.

Most of the caravan people either smoke or eat opium, generally the [illegible] take very small quantities [illegible] e to undergo the fatigue [illegible] nges of temperature and [illegible] sentery, the drug seems necessary as a physical stimulant to keep the men in good health

Acknowledgments.

The author wishes to record his thanks for the assistance and information he has received from the following officers Captains G P. Burrows, I S C, T H Davies, D S O, Devon Regiment, and Walker, D C L I, Colonel Yule, Devon Regiment, and especially so to Mr W H. C Minns, I C S, Assistant Commissioner, for having most kindly placed some valuable notes at his disposal

G I C. P O—No 1026 R & A—25 8 96.—2 100—W B G

H. 414—436.

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HORSES and MULES

Notes on Chinese Mules

MULE DRIVERS

Use of Opium

Use of Opium.

Most of the caravan people either smoke or eat opium, generally the former, they are however, most careful to only take very small quantities. If they run short of the drug they are unable to undergo the fatigue consequent on long marching, and from changes of temperature and exposure, soon suffer from diarrhœa and dysentery, the drug seems necessary as a physical stimulant to keep the men in good health

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Medical and Chemical Series, No. 3.)

THE AGRICULTURAL LEDGER.

1896—No. 4.

ARTOCARPUS INTEGRIFOLIA.

(JACK-FRUIT TREE)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. I., A. 1489.*]

THE CONSTITUENTS OF ARTOCARPUS INTEGRIFOLIA.

PART I.

Contribution from the Clothworkers' Research Laboratory, Dyeing Department, Yorkshire College, by ARTHUR GEORGE PERKIN, F.R.S.E., *and* FRANK COPE, *Reprinted from the Transactions of the Chemical Society, 1895.*



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Description

Wood.

Dye

[illegible] dyeing silk, and for general purposes

A sample of this wood was brought to England by Mr. John Ingleby, late Chief Surveyor* of the Northern and North Central Provinces of [illegible] Wood and Bedford, of [illegible] as a dye stuff, and [illegible] (Morus tinctoria), imported a considerable quantity from Ceylon, and to them our best thanks are due for a supply of material for the carrying out of this investigation.

Characteristic property of the dye

[illegible]

* Indian Civil Service.

warmed, assumes a beautiful blue tint, which, on standing, rapidly becomes green, and finally brown-yellow

THE COLOURING MATTER MORIN

Description of experiment to extract the dye

0.1254 dried at 160° gave 0.2740 CO_2 and 0.0394 H_2O. $C = 59.59$, $H = 3.49$.

$C_{15}H_{10}O_7$ requires $C = 59.60$, $H = 3.31$ per cent

Thus obtained, it appeared as a mass of colourless, glistening needles, ... somewhat sparingly in ether, ... 300°. Solutions of the alkalis ... hese liquids were treated with ... posited in the form of slender needles The barium and lead compounds were obtained as orange coloured amorphous precipitates insoluble in water. Sulphuric acid dissolved the substance $C_{15}H_{10}O_7$ with a yellow colour, and addition of ... green ... ntical ... fustic ... with ... green ... they ... small ... minute ... (*Ber.*, ...

Calico dyed with artocarpus resembles that dyed with old fustic.

In a former communication (Perkin and Pate, this vol., 649) it was shown that though morin yielded acid compounds very similar to those produced from quercetin and other allied colouring matters, it differed ... ound ... that ... oiling ... e red, ... acid,

Further experiments described

0 1382 gave 0 2358 CO_2 and 0 0400 H_2O C = 47 12, H = 3 21
$C_{15}H_8O_6 \, H_2SO_4$ requires C = 47 11, H = 2 62 per cent

The hydrobromic acid compound, obtained in a similar manner, was also analysed

0·1318 gave 0 2312 CO_2 and 0 0378 H_2O C = 46 77, H = 3 12
$C_{15}H_{10}O_7$ HBr requires C = 47 00, H = 2 84 per cent

The composition of the sulphuric acid compound, and a comparison of this and the hydrobromic acid derivative with those of morin obtained from old fustic left no doubt as to their identity The colouring matter of jack-wood is therefore *morin*.

Result of experiment

CYANOMACLURIN.

The aqueous filtrate from the lead compound of morin was treated

Cyanomaclurin

0 1209 dried at 160° gave 0 2769 CO_2 and 0 0463 H_2O C=62 46, H = 4 25

0 1170 dried at 160° gave 0 2688 CO_2 and 0 0459 H_2O C = 62 65, H = 4 35

$C_{15}H_{14}O_7$ requires C = 62 79, H = 4 65 per cent
$C_{15}H_{12}O_6$ „ C = 62 50, H = 4 16 „

It formed a colourless mass of minute prisms which when heated commence to darken at 200°, and decompose rapidly at about 25°.

on
nged
cetic
ays,
ot dye
rimson
ch on
urs its
te but
Most

Does not dye with mordants

Various dye colours obtained from cyanomaclurin

alis, for if but a trace be
ind go blue solution rapidly
green, and finally brown-
yielded no precip tate, and
was
any
crystall ne product as
it stands to jack woc , we
propose for the name of this substance *cyanomaclurin*

When an aqueous solution is boiled with dilute mineral acids, various

Cyanomaclurin allied to catechin and other substances of the tannin class

and though cyanomaclurin is not a tannin matter, in that it does not coagulate albumin solut on it is evidently allied to catechin, maclurin and other substances of this tannin class

It has been shown that various so called "tannic acids" among others Ch na—
and filix tanni
decomposed in
probably gluco
was obtained from cyanomaclurin and that the amount of final red product produced was equal to 85—90 per cent. of the weight of the or ginal substance

Alteration in colours the result of decomposition products

The alteration in colour of the freshly cut wood from a yellow to a
ibstances
evidently
decom-

Examination by Zeisel s method showed that it contained no methoxy groups

Action of Fused Potash

Action of Fused Potash—In studying this decomposition the substance was heated with 10 parts of potassium hydroxide and a l ttle water, at 150—180°, for about three quarters of an hour The dark coloured solution at f rst formed rapidly became brown, gas being evolved, and the operat on was d scontinued when this had cons derably moderated The melt was dissolved in water, the solution acid fied extracted with ether the extract evaporated, and the brown sticky residue allowed to stand for some hours over sulphuric acid Crystals were gradually dep sited and these were drained upon a porous tile, and purified by two or three crystallisations from water The product consisted of nearly colourless needles melting at 208—209°, an aqueous solution of wh ch

working with large quantities of cyanomaclurin to analyse the substance and confirm its identity

I ... the sole prod ct of the reaction, a
... e ethereal
... with lead
... y coloured
precipitate was obtained, too small to repay investigation

To the main portion of the solution, barium carbonate was added to
... to be ... recent, the ... hole ex ... ted

Action of Diazobenzene —From the results of the study of the reaction of diazobenzene with maclurin (C S Bedford and A G Perkin, this vol, p 933), it seemed probable that the former might also combine with cyanomaclurin, and experiment soon proved this to be the case. An
... had
... izene
... ished
... ohol,
a hot solution of which deposits it somewhat slowly in spongy masses of needles

Diazobenzene

0 1050 dried at 160° gave 0 2507 CO_2 and 0 0422 H_2O C = 65 11, H = 4 46

0 1199 dried at 160° gave 0 2863 CO_2 and 0 0486 H_2O C = 65 12, H = 4 50

0 1272 dried at 160° gave 12 c c of nitrogen at 20°, and 762 mm N = 10 92

$C_{15}H_{10}O_6(C_6H_5N_2)_2$ requires C = 65 32, H = 4 03, N = 11 29 per cent

$C_{15}H_{11}O_7(C_6H_5N_2)_2$ „ C = 65 21, H = 4 34, N = 10 14 „

It was evidently a compound of 2 mols of diazobenzene with cyanomaclurin It forms a scarlet, glistening mass, somewhat sparingly soluble in alcohol, but very considerably more soluble in the usual solvents than the corresponding maclurin derivative Dilute alkalis
... when treated
... ow liquids It
... , orange yellow
... ompound, but,

Action of alkalis on diazobenzene-cyanomaclurin compound

The analysis of cyanomaclurin agrees well, as shown above with either of the two formulæ $C_{15}H_{12}O_6$ and $C_{15}H_{12}O_7$, whereas that of its diazobenzene compound judging by the percentage of nitrogen, agrees somewhat more closely with the former, which is probably the correct

Result of analysis of cyanomaclurin

one Both are interesting as they tend to show a connection with either morin, $C_{15}H_{10}O_7$ or catechin, $C_{15}H_{14}O_6$, and with both these substances it has points in common

Further attempts to prepare acetyl, etc

Attempts to prepare acetyl and other derivatives have yielded at present unsatisfactory results and this is no doubt due to its instability in the presence of most reagents It is our intention to continue the study of this most interesting substance, but this work will of necessity be slow, for its isolation from the dyewood in any quantity will entail considerable time and labour

Tests to discover if maclurin exists in Jack wood

As morin has been previously only known to exist in old fustic, and as this dye stuff contains also a second colouring matter, maclurin it was necessary to determine whether the latter also existed in jack wood Various tests however, showed no indication of the presence of this substance, but in order to be quite certain it seemed best to prove this indirectly by examining old fustic according to the methods employed

Results

[illegible] acetic acid and allowed to stand some hours A light yellow precipitate gradually separated which was collected and purified by [illegible] s dyeing [illegible] acetate [illegible] in this [illegible] e to the fact that its lead compound at first formed, is partially decomposed by the acetic acid which is simultaneously liberated from the lead acetate On the other hand, morin is entirely precipitated by this reagent

Morin the sole colouring matter of Jack wood

Jack-wood thus treated as here shown yields no substance having the properties of maclurin and its non existence in this dye stuff is thus conclusively proved Morin is consequently the sole colouring matter of jack wood, and the cyanomaclurin which it contains occupies the place of the maclurin in old fustic

As the dilute acetic acid filtrate from the precipitated maclurin (see above) appeared to contain a second substance, it was evaporated to dryness a dark-coloured sticky residue being thus obtained When boiled with dilute alkalis an aqueous solution of this product darkened somewhat in colour, but did not yield the characteristic blue tint formed when [illegible] ir manner to the latter, [illegible] ids with formation of a [illegible] a substance not hitherto [illegible] ipitate with lead acetate solution and is therefore distinct from the tannic acid which according to Lowe (*Fresenius Zeitschrift fur Analytische Chemie*, 14 127) is present in this dye-stuff in conjunction with morin and maclurin This substance will be submitted to examination

Dyeing Properties

Properties of Jack wood dyes.

As was to be expected from the results of its chemical examination, jack wood dyes shades very similar to those of old fustic, that is olive-

yellow with chromium dull yellow with aluminium, and a brighter yellow with tin mordant. The results obtained, however, are somewhat disappointing when it is considered that its sole colouring matter is morin, for this by itself dyes fine bright shades, whereas those yielded by the wood are duller in comparison This must be accounted for as due to the brown decomposition products of cyanomaclurin which are probably formed to a slight extent during the dyeing operation, and also exist in the free state in the dye-stuff itself

Medium results of trials with the dye

Experiments showed that the sample of jack-wood here examined contained only about one-third of the colouring matter of old fustic. It is however, probable that this represents a poor quality, for that brought originally from Ceylon by Mr J. Ingleby was found equal to old fustic in dyeing power

Opinion as to colouring properties of jack-wood.

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ible Product Series, No. 19.)

THE

AGRICULTURAL LEDGER.

1896—No. 5.

CAMPHOR.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. II., C. 257.*]

CAMPHOR LEAF OIL.

By DAVID HOOPER, F.C.S., *Government Quinologist, Madras.* *Reprinted from The Pharmaceutical Journal of January 11th, 1896, with an Introduction by* THE EDITOR.

Consult the Agricultural Ledger on Cutch, No. 1 of 1895.



CALCUTTA:
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA.
1896.

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(4) To secure a connection between all papers of interest published on subjects relating to economic products and the official Dictionary of Economic Products With this object the information published in these Ledgers will uniformly be given under the name and number of the Dictionary article which they more especially amplify. When the subject dealt with has not been taken up in the Dictionary, the position it very possibly would occupy in future issues of that work will be assigned to it.

E. C. BUCK,

Secretary to the Government of India

(Vegetable Product Series, No. 19.)

THE
AGRICULTURAL LEDGER.

Correction.

Agricultural Ledger, 1894, No 16 (Embankments in Agriculture)

For Agricultural Series, No. 10,

read | Agricultural Series, No. 9. |

Agricultural Ledger, 1895, No 23. (The Indian Churn)

For Implements and Machinery Series, No 3,

read | Implements and Machinery Series, No. 2. |

N.B —Readers are requested to correct their copies by cutting out the lines enclosed by rules and gumming each one upon the line to be cancelled on cover and first page Two sets of slips are supplied for this purpose

grow almost anywhere in India The tree is an

expected to give any return. But if Mr Hooper's discoveries be regarded as manifesting a possible new direction, returns might be looked for within so short a period as to give the Camphor Laurel Tree a position in the planting world it has not hitherto enjoyed

C. 257.

Mr. Hooper, it will be seen, has been able to obtain Camphor in fairly large abundance from the oil distilled from the leaves.

It may be as well to here briefly indicate the botanical sources of ... to point ... made in ... to afford camphor

CHINESE.

1st—CHINESE (FORMOSA) and JAPAN CAMPHOR—This is obtained from Cinnamomum Camphora—*the Camphor Laurel Tree.*

It is the Common Camphor of modern commerce though not the article of historic fame The tree is a very slow grower and for perhaps half a century would not very possibly attain greater dimensions than that of an elegant large bush.

The Japan Camphor is generally preferred to the Chinese as it is, as a rule, purer *It is prepared by boiling chips of the wood similar* to the method pursued in India in the manufacture of Cutch. It comes into India in its crude state and a fairly large industry exists in refining it, chiefly at Bombay, Delhi, etc The refiner sells the purified article at nearly the same price as he purchased it, the profit being made on its mechanical absorption and retention of a large amount of water

BARUS.

2nd.—BARUS CAMPHOR (Bhimsaini Camphor) obtained from a tree fo[illegible] Camp[illegible] It is a [illegible] are fel[illegible] naturally formed camphor picked out from the tissue of the wood. The crystals are chiefly found in the interior of the stem often existing as concrete masses which occupy longitudinal cavities, more [illegible]

Conf with the Agricultural Ledger, No 1 of 1898, p. 6.

[illegible] collection it is very much more expensive than the Common or "Chinese Camphor"

NAGAL.

3rd—NGAI CAMPHOR of BURMA and CHINA—This is obtained from a species of Blumea and is manufactured very largely at Canton. The plant is a herbaceous or bushy member of the family of the COMPOSITÆ It seems probable that several species are employed, that most commonly being Blumea balsamifera—a species frequent in various parts of India as, for example, on the Eastern Himálaya between altitudes of 1,000 and 4,000 feet; on the Khasia hills, in Chittagong; Pegu and Tenasserim to China.

Ngai Camphor is chemically more nearly allied to Barus than to "China Camphor," and it is in point of price intermediate between

these two forms. Good Barus Camphor may fetch R80 a lb, whereas the Common Camphor is little more than half that sum per cwt

Note by DAVID HOOPER, *Government Quinologist, Madras.*

WORLD'S SUPPLY.

Japan.

Formosa.

India.

The camphor tree grows very well in India. The Calcutta Botanic Gardens possess a fine avenue of trees, which were introduced in 1802 It grows well in the Ootacamund Botanical Gardens and in other parts

Antiquity of the Camphor Industry.

ran, a large tract of land lying between Bengal and the Upper Irrawaddy Within the present century camphor was imported from Chittagong, but it has been said that the discovery of the hill-men of distilling it from the root led to the extinction of the trees

CEYLON

ITALY.

America.

Japan, as it had an
ene of an industry
l camphor and the
ree has also become
of the West Indies,

Slow growth of the tree.

It is very evident that the camphor tree is able to grow very luxuriantly and extensively in the warmer temperate and tropical parts of the world, far removed from China and Japan, but the slow growth of the tree would prevent all but large capitalists from opening up plantations and waiting for the plants to sufficiently mature If it is true that in the island of Formosa the wood only of the larger trees is used, and the leaves and branches rejected, then there can hardly be a scarcity of the trees, or the

[illegible] indicate that the camphor exists in every part of the plant including the leaves. On the other hand, it is remarkable that the leaves are not used in China and Japan; perhaps the natives have found that the leaves only give a liquid product which cannot be profitably turned into camphor. As there is no definite information on this point to be found in any description of the industry, I thought it would be interesting to try the effect of distilling the leaves. Another reason that encouraged me to make some experiments in this direction was the hearty manner in which some energetic planters of Ceylon have taken up the camphor question.

CAMPHOR from LEAVES.

Oil.

A large number of experiments have been made, and a great deal has been written with regard to camphor oil, the bye-product obtained in refining crude camphor before it is formed into blocks. This has been proved to be a very variable liquid with a specific gravity ranging from [illegible] to [illegible], [illegible] although usually to the right and [illegible] camphor in suspension, or in solution, or none at all.

Result of experiments with leaves.

The first sample of leaves came from an umbrageous tree growing in the Government Gardens at Ootacamund. Fifty pounds of the leaves in a fresh state were distilled in a large copper still with sufficient water for [illegible]. [illegible] of essential oil were separated from the distillate, giving the yield of essential oil of one per cent. The oil had a slightly yellow colour, a specific gravity at 15° C. of [illegible], and a rotation of +9°4 in a [illegible] tube. It gave off a small quantity of liquid at 160°, and began to boil [illegible] at 175°.

Collected below 180°	=	206
[illegible]	=	210
[illegible]	=	155
[illegible]	=	100
200°	=	56
[illegible]	=	[illegible]
Residue	=	[illegible]
		[illegible]

It has been [illegible] by some of the camphor congealing in the [illegible] of the amount, however, in this sample could only be about 10 or [illegible]. The residue in the [illegible] was quite solid in the cold, and had [illegible] colour.

[illegible] from a few younger trees grown at [illegible] more than a thousand feet lower [illegible] distilled in the same manner as [illegible] large quantity of camphor condensed [illegible] on the worm of the still. About [illegible] matter [illegible]

[illegible]

Collected below [illegible]	=	183
[illegible]	=	[illegible]
[illegible]	=	[illegible]
[illegible]	=	[illegible]
Residue	=	[illegible]
		[illegible]

[illegible]

Leaf Oil (*D Hooper*) CAMPHOR.

in the leaves. At any rate, it is interesting to know that a large proportion of the leaves and from the leaves om trees grown at a much lower f this useful substance could be

C. 257.

G. I. C. P. O.—No. 1257 R. & A.—18-5-96.—2,100.—W. B. G.

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THE

AGRICULTURAL LEDGER.

1896—No. 6.

ABROMA AUGUSTA, *Linn.*

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. I, A. 41.*]

HIBISCUS ABELMOSCHUS, *Linn.*

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. IV., H. 168.*]

MALACHRA CAPITATA, *Linn.*

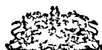
[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. V., M. 60.*]

REPORT ON CERTAIN INDIAN FIBRES.

Result of Examination in the Research Department of the Imperial Institute, London

Other articles that may be consulted:

Agricultural Ledger, No. 18 of 1894.



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E C BUCK,
Secretary to the Government of India.

(Vegetable Product Series, No 20)

THE AGRICULTURAL LEDGER.

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[Dictionary of Economic Products Vol I, A 41]

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[Dictionary of Economic Products, Vol IV., H 168]

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[Dictionary of Economic Products, Vol. V, M 60]

REPORT ON CERTAIN INDIAN FIBRES.

Result of Examination in the Research Department of the Imperial Institute, London.

[illegible]

Reason of present inquiries

a
ral

FIBRES	Moisture.	Ash	Hydrolysis (a) Loss	Hydrolysis (b) Loss	Mercerising Loss	Acid Purification Loss	Nitration Gain	Cellulose.	Length of ultimate fibre
	per cent.	per cent	per cent	per cent.	per cent	per cent.	per cent	per cent	m m
MALVACEÆ									
Hibiscus Abelmoschus (13 days steeping when in seed) . .	11	2	11·3	13·4	16·7	1·2	39·4	77·7	2·5—3

H. 168.

MALACHRA CAPITATA

Report on certain

FIBRES	Moisture	Ash	Hydrolysis (a) Loss	Hydrolysis (b) Loss	Mercerising Loss	Acid Purification Loss	Nitration Gain	Cellulose	Length of ultimate fibre
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent.	m m
MALVACEÆ—*contd*									
Hibiscus Abelmoschus (10 days steeping when in flower)	9 7	1 4	10 4	17 0	19 9	1 5	39 8	78 7	3 —4 5
Malachra capitata	12 5	1	12 3	17 8	13 7	2 6	35	74 2	4 —6
STERCULIACEÆ									
Abroma augusta (from new plant)	11 8	0 6	7 7	13 9	8 3	0 7	37 2	78 0	3
Abroma augusta (from old plant)	9 4	0 6	11 4	16 6	13 7	2 4	42 2	5	4 —6 4
Abroma augusta by Mr Cross '*Report on Indian Fibres, page 9*'	10 6	0 4	5 2	10 9	19 2	5 1	32 0	80	

Satisfactory results of examination.

The above are all of a high character, the colour being in each case good and the fibres free from reticulation and long in staple

Hibiscus Abelmoschus

Hibiscus Abelmoschus —Length of staple 3—5 feet The analytical figures for the two samples agree on the whole closely, but there is a noticeable difference of 4 per cent between the corresponding higher

Malachra capitata superior to average jute fibre

mation now ... p of the latter fibre

M. 60

Indian Fibres

ABROMA AUGUSTA.

Good results from examination of Abroma augusta.

Abroma augusta.—Length of staple 4—8 feet This member of the [illegible] ime of [illegible] xcellent, [illegible] which, [illegible] normal [illegible] ter of [illegible] dvan- [illegible] cellu- [illegible] ically [illegible] sub- [illegible] fibre [illegible] r loss in weight from hydrolytic action

The 17th January 1896 F A ABEL

G. I. C. P. O—No 1327 R. & A—15-6-96.—2,100—W. B. G.

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(Vegetable Product Series, No. 21.)

THE

AGRICULTURAL LEDGER.

1896—No. 7.

POLYGONUM CUSPIDATUM, *Sieb and Zucc. Fl. Jap. Fam. Nat. ii. 84.*

(THE ROOT.)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. VI, Pt. I., P. 1090 a.*]

SOME CONSTITUENTS OF THE ROOT OF POLYGONUM CUSPIDATUM.

Contribution from the Clothworkers' Research Laboratory, Dyeing Department, Yorkshire College By A. G. PERKIN, F R S.E *Reprinted from the Transactions of the Chemical Society, 1895.*

Other DICTIONARY articles that may be consulted.

P. aviculare, *Vol VI, Pt I*, P. 1078.
P. barbatum, *Vol VI, Pt I*, P. 1084.
P. Hydropiper, *Vol VI, Pt I*, P. 1095.
P. tinctorium, *Vol VI, Pt I*, P. 1108 a.
Rhamnus frangula, *Vol VI, Pt I*, R 156 a.
Ventilago madraspatana, *Vol VI, Pt IV.*, V. 56.
also
The Agricultural Ledger No. 9 of 1895.



CALCUTTA:
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA
1896.

(Vegetable Product Series, No. 21.)

THE

AGRICULTURAL LEDGER.

1896—No. 7.

POLYGONUM CUSPIDATUM.

(THE ROOT)

[*Dictionary of Economic Products, Vol VI, Pt I*, P. 1090 a.]

SOME CONSTITUENTS OF THE ROOT OF POLYGONUM CUSPIDATUM.

Contribution from the Clothworkers' Research Laboratory, Dyeing Department, Yorkshire College By A G PERKIN, F.R S.E. *Reprinted from the Transactions of the Chemical Society, 1895*

Among the different varieties of the species Polygonum, that best known is perhaps the P tinctorium, the leaves of which are used as a source of indigo in China, Japan, and some parts of Russia Of others, the P. aviculare and barbatum yield a blue colour, probably indigo, and the P. Hydropiper and tortosum are said to contain a yellow colouring matter, moreover, the roots of some of these varieties possess medicinal value

The P cuspidatum, which is common in parts of India, China, and Japan, has evidently attracted but little attention, the only reference found bearing on its properties being the following, contained in a paper [illegible]

The roots
of a thick
central light
lerably and
ody portion
ved, and of

EXPERIMENTAL PART.

The Glucoside Polygonin

The ground root bark was extracted twice with 10 times its weight of boiling alcohol for six hours, and the resulting orange-brown extracts evaporated to a small bulk. The residual liquid, from which nothing separated out on standing, was treated with water and extracted with ether, the ethereal solution being placed aside for subsequent examination. The addition of baryta water to the aqueous liquid produced a dirty white precipitate, which was removed by filtration, and washed with water until the washings were nearly colourless. The deep red filtrate, after being neutralised with acetic acid and saturated with common salt, was extracted with a large volume of ethylic acetate, and the extract evaporated; as the solution became concentrated, a brown gelatinous

crystalline substance gave the following numbers —

0·1151 gave 0·2460 CO_2 and 0·0510 H_2O C = 58·28; H = 4·92.
0·1091 „ 0·2340 „ „ 0·0495 „ C = 58·48; H = 5·04
0·1095 „ 0·2325 „ „ 0·0495 „ C = 57·90; H = 5·02.
$C_{21}H_{20}O_{10}$ requires C = 58·33; H = 4·63 per cent

It consisted of a glistening mass of orange-yellow needles, which, when heated, softened at 200° and melted at 202—203°. From its solution in boiling alcohol, in which it is but sparingly soluble, it is deposited in a gelatinous condition if rapidly cooled, but when left to cool slowly it separates as a bulky mass of hair-like needles. Boiling water and eth[illegible] acetate d[illegible] ...ost insoluble in ether ...s orange red liquids and ...ibstance with alcoholic ...oling, in the form of red, orange red amorphous ...med when lead acetate

Emodin

[illegible]

boiling water was added a little at a time, and the mixture allowed to cool. The product was collected, washed with water, and dried at 120°.

0·1224 gave 0·2980 CO_2 and 0·0450 H_2O. C = 66·39, H = 4·08.
$C_{15}H_{10}O_5$ requires C = 66·66; H = 3·70 per cent.

decomposed with a slight explosion when strongly heated, and evidently consisted of a nitro-derivative. To convert the substance $C_{15}H_{10}O_5$ into its acetyl compound it was digested at the boiling temperature with a

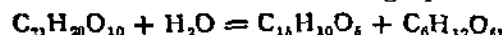
rystals
-yellow
These
roxy-a-

nitro-derivative.

A determination of the amount of emodin produced by the hydrolysis of the glucoside gave the following result:—

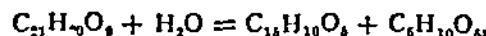
0·3858 glucoside yielded 0·2385 emodin, or 61·82 per cent.

This result is in accordance with the following equation:—



$$C_{21}H_{20}O_{10} + H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_6,$$

isation with silver carbonate
syrup, but obviously in too
n of the substance reacted



$$C_{21}H_{20}O_9 + H_2O = C_{15}H_{10}O_5 + C_6H_{10}O_6,$$

the Polygonum cuspidatum.

Emodin Monomethyl Ether.

trength Its solution in sulphuric
orresponding solution of emodin
struck not only by the nearness
of its melting point to that of emodin methyl ether (m p 200°) found in the root bark of the Ventilago madraspatana (Perkin and hummel, *Trans*, 1894, 65 932) but also by the similarity of their appearance and proper-

finally, from toluene The orange coloured needles thus obtained melted at 253—254°, dissolved readily in ammonia, and, without doubt, consisted of emodin It therefore follows that the substance melting at 199° obtained from Polygonum cuspidatum, is identical with the emodin monomethyl ether which exists in Ventilago madraspatana. In the

The Wax

of the glucoside,
neutralised with
d and purified
orange-coloured
emodin The
quantity of emodin obtained from the root in the free state was exceedingly small.

As
evapor
small
warty
tion
resembled phenanthrene in appearance, and melted at 134—135°. In

P. 1090 a.

This proved to be the case,

0·0536 gave 0·1635 CO_2 and 0·0560 H_2O. C = 83·19, H = 11·60
$C_{15}H_{25}O$ requires C = 83·08, H = 10·75 per cent

emodin methyl ether, also a connection with Ventilago madraspatana root and a similar relationship with the Morinda umbellata, in that they both contain identical waxes

Dyeing experiments with the root, using mordanted calico, showed, as
of t

the root with regard to this property

It is my intention to study the constituents of the roots of the Polygonum bistorta and Rumex nepalensis—members of two closely allied species.

* The melting point of this wax given in the former paper is 124—125°, an error which appears to have arisen during the correction of the proof sheets.

G. I. C. P. O.—No 1328 D R. & A.—16-6-96.—2,100.—W B G

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series

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This sheet and the title page may be removed when the subject matter is filed in its proper place, according to the letter and number shown at the bottom of each page

(*Veterinary Series, No. 1.*)

THE

AGRICULTURAL LEDGER.

1896—No. 8.

OXEN.

(CATTLE DISEASES)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. V., O. 551-594.*]

SELECTIONS FROM THE REPORT OF THE INDIAN CATTLE PLAGUE COMMISSION, 1871.

By VETERINARY CAPTAIN H. T. PEASE F Z S, *Assistant to the Inspector-General, Civil Veterinary Department.*

Other DICTIONARY articles that may be consulted:

Camel, *Vol. II*, C. 222;
Deer, *Vol. III*, D. 208-242;
Elephant, *Vol III.*, E. 122;
Sheep and Goats, *Vol VI., Pt. II*, S. 1225-1645;

also

Agricultural Ledger, 1893, No. 19; 1895, Nos. 10 and 12.



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1896.

The objects of THE AGRICULTURAL LEDGER are —

(1) To provide information connected with agriculture or with economic products in a form which will admit of its ready transfer to ledgers,

(2) To secure the maintenance of uniform ledgers (on the plan of the Dictionary) in all offices concerned in agricultural subjects throughout India, so that references to ledger entries made in any report or publication may be readily utilised in all offices where ledgers are kept,

(3) To admit of the circulation, in convenient form, of information on any subject connected with agriculture or economic products to officials or other persons interested therein,

(4) To secure a connection between all papers of interest published on subjects relating to economic products and the official Dictionary of Economic Products With this object the information published in these ledgers will uniformly be given under the name and number of the Dictionary article which they more especially amplify When the subject dealt with has not been taken up in the Dictionary, the position it very possibly would occupy in future issues of that work will be assigned to it

(Special Veterinary Series, No. 1.)

THE
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I.—INTRODUCTORY.

INTRODUCTORY

conduct of the investigation and the drawing up of a report thereon were—

(1) to determine the nature of the diseases prevalent,

Objects of the Commission

rinderpest, and which might check the

2 These instructions and objects have been steadily held in view during the protracted and laborious inquiry which commenced on the 21st of December 1869 and terminated on the 31st of January 1871 It was

Mode of inquiry.

OXEN.	Selections from Report of Indian Cattle

INTRODUCTORY

testimony and a means of obtaining written information As this form, which was most carefully considered at starting, embodies the whole spirit of the inquiry, it will be convenient also to adopt it as the groundwork of this general report

Extension of sphere of inquiry

3 At first, the limitations imposed by the original instructions were carefully observed, but it was found that an expansion of both the field and subject of study would be attended with advantageous results It became apparent, in the first place that very serious events were occurring in the Panjab, involving the destruction of cattle by thousands and, from the descriptions of the murrains causing this havoc which were received, it was impossible to predicate their nature or advise as to their treatment A local investigation in this province was accordingly suggested, and authority was readily obtained from the Government of India to extend operations thither It was next found that important information was

The Panjab

Other provinces Madras

Bombay, Central Provinces Burma and Andaman Islands Ceylon

thus become imperial in its scope though the Bengal Presidency is necessarily more prominently and elaborately represented Through the

Cattle-poisoning

true and proper light

Proceedings of the Commission

4 While the objects of our Commission were those above indicated, the principles upon which the work has been carried on have been as follows —

Local observation

(1) local investigation and actual observation have been held as the most important means of arriving at accurate results,

Personal investigation

(2) personal inquiry on the spot, in the locality where the events had occurred or were occurring and from the persons best informed regarding or most concerned in, the matter, was considered as second in importance, and

Written reports

(3) when neither of these means were available, written reports were sought from the most skilled and competent persons likely to give the most reliable information

Arrangement of the report

5 The result of these endeavours has been the accumulation from every part of India of a large mass of material of very various value When the time arrived to arrange this material so as to place it in that [illegible] with [illegible] an [illegible] ible [illegible] ing-

According to locality

O, 551-595.

ient, the
ry with,
l, are set

best advantage Much yet remains to be known and nearly all to be done This report contains or refers to all that is known up to the end of 1870, and prescribes what ought to be done There should be no necessity for again working out the subject generally as far as the past is concerned, but there remains the necessity of continuing the inquiry in every district of India, and these developments ought to be an
contained
one skilled
first and
y strongly
be done
ying mor
de Cata
together of
hearsay symptoms and tabular exhibitions of unreliable figures, have hitherto represented, save in a few exceptional cases the summit of energy In future names and symptoms should be reduced to the minimum, a few familiar names should represent well known symptoms, and figures and tabular statements should exhibit work done, sickness and mortality reduced, and disease stayed by the prompt adoption of
der the
ation
train
ed in
field,
and
drawing up general reports are of course necessary, and we trust that year by year, commencing with 1871, the progress of this important matter will be duly chronicled, but unless the local action is such as we have above indicated, reports, however careful, can never advance the question one single step, or contribute to the saving of one single life

Inquiry complete up to the end of 1870

Need of further inquiry.

OXEN.	Selections from Report of Indian Cattle

MURRAINS, CONDITIONS AFFECTING PREVALENCE OF

II.—CONDITIONS AFFECTING THE PREVALENCE OF MURRAINS.

Topography.

6 Topography has been found to have an important bearing on the prevalence of murrain

Insulation

(*a*) If an absolute conclusion can be drawn from one example, the - Islands disproves the allegation importation is the main, if not foot and mouth disease even lemic diseases are rife among drawn from the experience of rve the stock of an area free of an island impose as regards outside stock must be imitated artificially—that is, localities must be, in respect of importation of disease, insulated

Hills

(*b*) Hills oppose another physical obstacle to cattle association, and provide for a certain amount of isolation of stock We have accordingly found that, as far as our information of hills and hill stations permit a general statement, disease is not so frequently met with upon them, and, when it does occur, its importation is always traceable and there is never

Rivers

(*c*)
and tl
them
Lakhi
portioi
1869, and it was then derived from the South The importance of guarding ferries, which are a means of rendering futile the protection which rivers afford, is obvious

Grazing-grounds.

(*d*) The influence of luxuriant pasture tracts where cattle are herded and grazed, drawn from many points, mix together, and are then

problem of prevention and limitation must here be worked out locally, as, wh le the general practice and its tendencies and dangers are s milar, there are local circumstances and variations which must govern the thought and action to be taken

Roads

(*e*) The influence of roads in spreading disease is well known and illustrated in

Civilisation and clearing

(*f*) of jungle, making of ro with other parts buying the spread of contagious he case of Burma

Influence of soil

(*g*) Our observations have been mainly conducted on the plains and upon an alluvial formation, but nothing that appears in these papers tends in any respect to establish a relation between any kind of country and soil and murrain except in as far as variations of this sort modify the other life conditions of stock namely, number, association, etc. In other words, there is no evidence to show that cattle disease may and does not prevail on any area, whatever its geology, soil, altitude, etc.

Disease not soil born

O. 551-594.

MURRAINS CONDITIONS AFFECTING PREVALENCE OF

observat on or inqu ry has reached they have been found to preva l or to have recently preva led It is certa n that the *reported* murra n has formed but a small share of what really ex sted We cannot suggest a spot in Ind a n wh ch we bel eve that both forms have never occurred, but h le th s is true t s true also that in any one year the geographical d stribut on of murra ns w ll show large blanks of murra free d visions and d stricts or smaller areas Were nqu ry m re m nute these blanks would probably be smaller and fewer than they are bel eved to be and in places such as Calcutta where cattle are massed an annual murra n map would show an annual murra n t nt but t s these blanks h ch g ve cause and room for act on If they d d not ex st act on would be mpos s ble and the a m of act on must be to preserve from year to year the blanks wh ch ex st and extend them In a d st ct checkered as many or most w ll be found to be w th murra n patches act on must be correspond ngly deta led and d fficult It s hardly necessary to suggest that an annual murra n map for Ind a show ng accurately the areas affected would be of itself a very nterest ng and mportant record

Geographical distribution of murrains

Murrain map

7 The number of cattle n a certa n a ea has n no nstance been prec s ly est mated nor can any rel able genera statement be made w th regard to the effect of crowd ng on the preva ence of m rra n The general rule may be accepted as true that a sparsely scattered stock

Number of cattle

Herding

Calcutta byres

to owners and and was e c eu at Chuadanga n t e Nuddea D str ct namely that o ng to the ncreased relat ve p oport on of land brought under cult vat on the consequent decrease of pasture land and the increased number of persons engaged n ag culture the number of cattle wh ch each owner possesses has been reduced to the m n num whereas n former years ryots always o ned a s rplus of cattle and as the people *of Assam now do held cattle as a representat ve of means or wealth, now* the r value cons sts n the r work as agents for agr cultural product on D v s on is held source of ga n o n both number t mportant and

Relative diminution of stock

measures becomes more declared and press ng

8 A cons derat on of the breeds of cattle does not form part of our instruct ons or purpose but a great deal of information on th s subject is

Breeds.

OXEN	Selections from Report of Indian Cattle

MURRAINS CONDITIONS AFFECTING PREVALENCE OF.

powerful influence in spreading disease and must be known in order to have this influence obviated Much of this kind of information is given in our report but the local conditions governing the problem of prevention must be exhaustively studied in each locality before effectual preventive measures can be devised

Housing of cattle

12 The housing of cattle is an almost universal practice, and, as a rule, we have found the sheds used well adapted for their purpose On this head we have no suggestion to offer, except that, in some instances, they are manifestly overcrowded The Calcutta cattle dairies, for instance are as crowded as they can be, and the arrangements for removing filth are exceedingly defective

Feeding and watering

13 The system of feeding and watering cattle has invariably been inquired into and it is evident that there is room for reformation here In some places feeding is well understood and is reduced to a system as in the Calcutta dairies and oil sheds where the kind cost and effect on milk of various plans of feeding are well known Again, in the district of Nuddea the feeding of plough and dairy cattle in relation to

of care and system

Effects of improper feeding

1st —During the cultivating season when much land is under crop pas ... fodder is ... ondition ... learnt to

2nd —During the dry months, in many places, the herbage is so scanty and dry that innutrition wasting and impaction (Fardel bound) are the consequences A good illustration of this was observed at ... we ... is ... the Panjab

4th —In 1869 an absolute scarcity of fodder caused, in some districts of the North Western Provinces, a great loss of cattle by starvation, this resulted from simple improvidence

5th —After the first shower of the rains a delicate rich growth of young shoots takes place The cattle previously starved and accustomed to the driest pasture, browse eagerly on this sweet succulent herbage and the consequence is a fatal attack of hoven This is a universal observation, and many cases of the mysterious *puschima* of Lower ... ausing ... lwson a ... xercise and change of pasture has been adopted there as a standing rule

7th —The evil effect of eating grass which has been submerged is very frequently alluded to in the evidence and reports, but no opportunity occurred of studying practically the effects of this kind of pasture It is a subject worthy of attention

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serious question of pasture land is one which we would particularly bring **Pasture land.**

ractical attention
hap hazard principle
spreading disease
centre of a village of
taining gruelly-green
whose banks cases

Watering.

labouring under rinderpest were seen A place of this sort is nothing else than a pit in which healthy cattle bathe in diluted rinderpest discharges It was an extreme case, but by no means an uncommon one The single case of rinderpest which had occurred in a village of Burdwan—Gangpur—had not only been housed and fed separately, but watered in a separate pond This matter of common watering places must not be lost sight of in any scheme of segregation Enough is not known of the contagium to say that it does or may act through or by water but the necessity of the precaution is obvious Cattle labouring under rinderpest have an abnormal thirst and make for ponds and watering places and the observation has frequently been made that their carcasses are more apt to be found near tanks, ponds etc The quality of the water which cattle have to drink is in some cases very bad as in the instance of the Calcutta dairies A filthy fluid containing all kinds of abominations is plainly improper

14 The subject of herding is undoubtedly one of the most important in considering the spread of contagious disease and its prevention The following are the principal kinds of herding practised in Bengal — **Herding.**

1st —Herding for pasture, when the cattle of different homesteads or villages are collected and driven to a fallow field or tract where they mix together.

This practice is universal, and a necessary adjunct of the village system

2nd —Herding for pasture when cattle are driven to other and distant places for pasture

This practice is a very frequent one

3rd —Herding on breeding tracts

4th —Herding and droving for market

5th —Herding and droving for sale amongst villages

All of these varieties of herding, which have been made a part of the local inquiry, are simply so many agencies of the spread of infectious diseases, and in any plan of preventive effort they must, as such, be minutely taken count of.

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OXEN.	Selections from Report of Indian Cattle

MURRAINS, CONDITIONS AFFECTING PREVALENCE OF.

Supply of stock

Local breeding

15 The necessities of replenishing stock furnish another channel of

Streams of cattle movement

ment do not, however, depend solely on agricultural demand, but, where cattle are used for their meat or milk, an additional demand arises These causes determine certain constant routes of cattle droving which are liable to little variation

Many of these have been studied and displayed, but these streams must be accurately defined in each district We need only here refer very generally to the wide radii of cattle movement which the

disease about with them without hindrance

Markets.

16 The subject of markets has been held prominently in view Their influence in spreading disease need not be urged here, it

disease at the Ulubaria fair The outbreak of the same disease—rinderpest—in Benares and Dinapur in 1869 was clearly traced to the same fair, Kat Berhampur in the Shahabad district.

Calcutta markets

The important markets around Calcutta were made a subject of special and careful attention
that cattle markets m
inspection and exclusi

Hide trade.

17 Much informa
scattered throughout
certain that the hide
with the exception of Assam and th
throu
is a
be a
of co

notice, there is every reason to think that it may be thus conveyed, and preventive action, to obviate this risk, must provide for the destruction or disinfection of hides. We would recommend the adoption of the latter course Efficient soaking in lime or salt and water, as is done in many cases, is known to render the hide innocuous, as far as conveyance of disease is concerned, but at least 3 or 4 seers of lime or salt

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DISEASE OF STOCK

ch piece, and the thing must be done thoroughly *in the spot* If this cannot be attained, then the of skins, or their destruct on in any other way, is tation should exist when the alternatives are a few ig cattle. The subject of cattle poisoning and its trade have been carefully studied, and the results r that the allegation that all, or most, of the mur- cattle poisoning has been proved groundless by the ons we have made and the fact that in Assam and ere no trade in hides exists, disease is as rife as

Cattle poisoning

lightly touched upon the conditions under which lating the origin or spread of murrain,—and the ana prepared will provide a key to a more elaborate mation which has been amassed on each subject,—we forth the principal conclusions at which we have

I.—*DISEASES OF STOCK.*

History of murrains.

ie history of murrains, l ttle need be said here All ered under this head has been given in the ' historical livis on, in which all the recorded outbreal s in each

ti sk dis of exci give case the fi preva every cles to which w increase and is ev is to be e carefully be furnishe their area o and we have sufficient experience to convince us that local effort must be stimu this direction Unless there is some department which will furnish s stimulus and record results, valuable information must be lost, and if events are not recorded as they occur, the demon strated general prevalence of 1870 will be succeeded by an apparent ... will be of more defi- ular places, regard to e and shall remain in complete ignorance

Narratives

Diseases of horned cattle.

20 The most important diseases of horned stock of which we have obtained experience or authentic information are —

1st —Rinderpest.
2nd —Foot and mouth disease.

* Not issued

OXEN.	Selections from Report of Indian Cattle

DISEASES OF STOCK

3rd.—Hoven.
4th.—Quarter-ill.
5th.—Pleuro-pneumonia (ordinary?)
6th.—Bhuknf or purging.
7th.—Cystic disease
8th.—Throat swelling.

Reserving rinderpest for special consideration, we shall shortly state the conclusions at which we have arrived regarding the others.

Foot and mouth disease.

21. *Foot and mouth disease* is a universal disease of cattle in India, causing a considerable amount of sickness yearly, much disabling of cattle, considerable inconvenience, but no great mortality. It appears to be even more common and frequent than any other form of cattle disease, and, if we may judge from the experience of the Andaman Islands, more penetrating and persisting. It gen[illegible] may prevail at other times Villa[illegible] Madras, Bombay, etc —and Ceylon [illegible] ises of this disease [illegible] epizootic studied [illegible] in this case the infectious nature of the malady and its disastrous consequences under some circumstances were [illegible] ausing exceptional severity in this [illegible] s after the disease had commenced [illegible] case exactly parallel is described [illegible]

Prevalence.

Names.

The vernacular names by which this disease is known are very various, but generally derived from words signifying mouth and foot separately or in combination,—*muhpuccah*, *khurpuccah*, *muhkhur*, etc., etc The symptoms of this malady need not be detailed here, they are well known The most frequent cause of death is inability to feed owing to disease of the mouth, or severe ulceration of the feet, owing to the development of maggots The native methods of treatment are various. The most common plan is keeping the cattle standing in muddy water, this prevents the access of flies Various astringent barks, *babul*, etc, are also applied in some places. The undoubtedly infectious nature of this [illegible] and segregating t[illegible] during the cultiva[illegible] doubled, in order [illegible] causes; but, consi[illegible] system of treatme[illegible] loss of time and money would not be entailed by elaborate preventive measures than by any sickness which might prevail, notwithstanding cleanliness, disinfection, and simple precautions As regards medical treatment nothing can be better than carbolic acid and oil (1 part to 40), or camphor and oil (1 oz [illegible] feet and to prevent acce[illegible] grs. to 1 oz) as a wash [illegible] dmi-nistered at the outse[illegible] the strength with soft m[illegible] arts clean is of great im[illegible] eful. Detached portions c[illegible] n is adopted the loss fro[illegible] The question of the pow[illegible] was constantly held in view, but we were unable to arrive at any definite

Treatment.

DISEASES OF STOCK.

solution of it. The general testimony of the people was to the effect that one attack was not protective, in this we concur, and it is all the more remarkable in contrast with the almost unanimous belief they expressed in the protective power

Hoven.

22. *Hoven* is an exceedingly
Indian cattle, and vivid descripti
dependent upon errors of diet,
distention of the rumen with food or flatus It is known by a great variety of names, and is most common in the early rains There can be no doubt that much of the *puschima* of which we heard so much in the Presidency and Burdwan divisions, is hoven In general, it has a more expressive name, *pet bhaga* (swollen stomach) is a very common term, or some equivalent. After a smart shower of the early rains, when succulent shoots spring up as if by magic, cattle which have been nearly starved for weeks are apt to over-feed themselves Several animals of a herd, or among a village stock, may thus be seized with hoven, and the affection may almost appear epizootic. It is obvious that, as long as no care and system are pursued in regulating cattle feeding, they will be liable to this disease as often as a cause arises, and there can be little doubt that cases of this sort are often mistaken for murrain or poisoning Another condition, which also proceeds from improper feeding, is impacted stomach, caused by animals in the dry weather having to subsist on withered stems or dry roots of grass Two cases of this sort were seen at Bhabua in Shahabad, and they are no doubt very common The treatment of cases of this description need not be entered upon here, it is matter of common veterinary

Fardel-bound

Diffusion of veterinary ...o.

known, as regards causes, pathology, and treatment, and, as they owe their origin to causes which may affect the members of a herd in common, they may assume the aspect of an epizootic, indeed, it will be

throughout rural India

Pleuro-pneumonia.

24. *Pleuro-pneumonia* is undoubtedly met with in some parts of India, and convincing evidence of the existence of this disease was obtained in the Panjab, where cases were seen and examined *post mortem*

O. 551-594.

OXEN.	Selections from Report of Indian Cattle

RINDERPEST

geons of the public serv ce, and it is unfortunate that they are debarred from the only source of information and experience which is available for them, and sound ad
while the special experienc
Valuable experience is a
at Hissar and Hunsur,
of regret that this large field of observation is lost for purposes of systematic examination and record of the diseases of cattle

IV.—RINDERPEST.

Europe, as recorded in the reports of the English Cattle Plague Commission and Veterinary Department of the Privy Council, and in systematic works, an exhaustive consideration of all that has been written on the subject in India and Ceylon, an extended and minute inquiry, oral and documentary, a very large experience of the disease as manifested by living animals in a great many parts of the Presidency of Bengal, and an elaborate practical study of the *post mortem* and microscopic appearances of the organs and tissues of subjects which have d ed of the disease,—we have, without any prejudice or pre conceived opinion to ... lusion that

Identity of Indian and European rinderpest

... murrain of ... is as that ... npossible to ... of breed, country, climate, and other ... conditions, so accurately as to exhibit exact identities spreading in every case into every detail, but taking a broad view of the nature and behaviour of this murrain, as displayed so copiously, and in many cases elaborately, by numerous independent witnesses in the succeeding pages, the resemblance is complete, whether we take the whole history of an outbreak, the whole *ensemble* of the phenomena of cases, or particular syr

Opinions of Medical and Veterinary authorities

This opinion has invariably bee
veterinarians who have made the dis
in 1848 pronounced the *bara asar*
"[murrain of Europe" Dr C Palmer

O. 551-594.

RINDERPEST

and Assam, has no doubt or hesitation on the subject And, lastly, the Ceylon Cattle Disease Commission pronounce the following judg-

unanimity and the independent manner in which they have been arrived at are weighty points The variations which may be noted between the English plague and our descriptions are no greater than we have ourselves noted in different forms of the disease in this country, and no greater than may be ob[illegible] human small pox, and c[illegible] and Indian disease is [illegible] climate are so different.

The only certain test of identity.

wanted, the matter may finally be set at rest by inoculation under proper precautions, of cattle in England by material derived from the Indian plague We do not undertake the responsibility of initiating or advising this crucial test, for we are too assured of the nature of the Indian plague to doubt its danger and impropriety, but it is incumbent on those who [illegible] r futility from [illegible] only means [illegible] cal identities, [illegible] ase on which

Contagiousness and importability.

preventive [illegible] that, for [illegible] we have [illegible] half the c[illegible] contagio[illegible] this unan[illegible] appear s[illegible]

Opinions

witnesses have expressed themselves without hesitation on the subject, and [illegible]

Instances.

du[illegible] sep[illegible] by [illegible] is [illegible] wel[illegible] Di[illegible] village [illegible] owing. Some of the cattle of a healthy village were im-

origin could not be explained, the cause was most probably want of

O. 551-594.



OXEN.	Selections from Report of Indian Cattle

RINDERPEST

power of accurate and intelligent observation The progress of the disease in a village was generally traceable The first two or three houses in wh
amount of c
dependent o
some cases,
and the introduction of the murrain from the grazing tracts of the Tarai and elsewhere into the villages of the adjoining districts is illustrated frequently

Whether, then, the broad features of the movement of this disease across the country, or the circumstances of its progression in a village, or facts regarding the infection of particular animals or of a single shed or byre, be considered, they all point in one direction, indicating that

Proved experimentally

Infecting distance

conclusions.

Conclusions.

As far as our observation has gone, we believe,—(1) that this murrain is a highly infectious one; (2) that its propagation is due mainly or entirely to that circumstance, (3) that all the incidents of particular outbreaks, if properly investigated, and with a due consideration of all

practical effort is concerned.

once attacked are not, as a general rule, again attacked; and, seeing that the disease is so frequent a periodical visitant of all the districts of India, the proportional number of animals thus protected must be considerable. The conditions under which infection operates still remain to be studied We do not pretend to be able, from the cursory glance we have been compelled to take over an immense field, to indicate all

Plague Commission, 1871. (*H T Pease*) — OXEN

RINDERPEST.

these conditions · this must be subject of future observation, but the influence of conditions, such as crowding, cleanliness, season, etc , etc , can only introduce modifications or qualifications of the general law of communicability, which is both fundamental and of primary place and importance

Season

One of the most potent of these conditions is, no doubt, season, and on this point the evidence indicates the rainless and hot months as being *those in which this murrain most frequently occurs It follows* in this particular human small pox and cholera, and is amenable, like them, to the repressing effect of heavy and sustained rain As regards the pre disposing effect of breed, age, sex, and condition, the general impress on obtained was, that none of these conditions possessed much power in determining or deterring What the so called "epidemic constitution or influence" is which provides that in one year or season epidemics or epizootics shall prevail, and in another not so we are quite unable to say, and, for purposes of action, we are of opinion that communicability

Statistics

of the tables given have been drawn up rather with a view to exhibit the distribution of murrain than from any belief in their statistical value It is, however, convenient, even if exact results cannot be obtained, to express sickness and mortality in terms of figures, and for a single return informing of a complete outbreak, or a first report giving intimation of a new invasion, the form shown on pp 82 83 (entries 3 to 8) is sufficiently convenient, but where a series of reports—weekly, monthly, etc.—have to be submitted, there is always a doubt as to how the "still ill" have been disposed of, indeed it could not be improved on, but if different species of disease can be clearly distinguished, they should be shown on separate forms, or as separate entries in one form It is obvious that exact results obtained in one or a few villages are more valuable for statistical purposes than unreliable data referring to a large area; but, for purposes of general information figures, even if approximate, give a better idea of how the case stands than records

Loss by murrain

As regards the losses of stock incurred through this plague, while exact informat on is very much wanted, it is evident that the yearly loss, both absolute and relative to number of living stock all over the country, is very serious, and to be counted by hundreds of thousands *Hitherto* the actual hardship and inconvenience entailed by it, as regards agricul-

area,
gricul-
Cattle
comes
ne to
Opera-

tions may be apprehended

Treatment.

32 The treatment of rinderpest may be considered under the usual heads *of curative and preventive Medical treatment commends itself* to the favour of the natives of this country by its facility of application and the absence of interference with their liberty of action, and there is such an inveterate habit with them of taking things as they come, and such a decided aversion to initiating any new course of action, that, though they know the contagious character of the disease, and admit the propriety of segregation, we have found that this measure is seldom

* Not issued.

O. 551-594.

OXEN	Selections from Report of Indian Cattle

RINDERPEST

or never adopted. Attention to animals which exhibit the results of infection is the first thought in a scheme of relief, as the phenomena are patent and excite direct notice, but the conduct dependent on the inferred impalpable phenomena which precede the seizure is not so urgently [illegible] Thus it hap[illegible] esteem, and [illegible] d to danger [illegible] are wanting, [illegible] ieving that a [illegible] than doing nothing, efforts to cure will hold an important place in popular estimation with the natives of this country, and cannot be laid aside.

Medical treatment

33. The natives in most places confess their powerlessness to treat this disease and the statement "there is no medicine for *matah*" will be found to be a frequent village confession. When they do attempt any treatment, it is often fanciful or absurd. Feeding with rice gruel or other soft food is the most rational measure they adopt, but even this plan is [illegible] to recover [illegible] me absur[illegible] practised [illegible] *tolah* and sacrifices at her shrine are much more approved remedial measures than drugs or applications, and in some cases the aid of the village *chamar* is invoked to repel some demoniacal influence.

Trials

Medical treatment has, however, been largely tried by European [illegible] at our [illegible] itted for [illegible] ted that they soon became so. Such were nearly all the cases brought to us in Assam. The general result of our hospital trials—52.1 per cent of [illegible] uraging, but taking [illegible] were received, and [illegible] manifestly aided in [illegible] we are of opinion [illegible] will save a consi[illegible] e succumb to the [illegible] summed up as follows:—

Conclusions: specific

I.—No specific has been discovered for this disease and it is difficult, looking at the nature and [illegible] conceive the possibility [illegible] would avail in the very [illegible] the sequence of future ev[illegible] unless, where it is manifes[illegible] early rise in temperature [illegible] preventible, and there is [illegible] [illegible] practicall[illegible] at an early stage, and there is no warrant for prophylactic treatment of [illegible] otherwise than by disinfectants, even if such a measure were [illegible]

Laxatives

II. Mild saline laxatives in the early stages are undoubtedly advantageous, but we have found severe purgation positively harmful.

Astringents

III. Astringents to control excessive action of the bowels are valuable in the culminative stage of the disease.

O 551 591

RINDERPEST. Stimulants. Drenches

IV.—Stimulants judiciously given, when exhaustion threatens, often turn the scale in the direction of recovery
[illegible]

Water.

[illegible] rapid death

Saving of stock.

VII —If these measures are adopted with judgment, perseverance, and care, we believe that at least 20 per cent. of animals which would otherwise die may be saved

Preventive treatment.

34 The subject of preventive treatment is, for obvious reasons, a far more important one than medical treatment, and has always had a principal place in the thoughts of those, whether individuals or commissions, who have given the subject attention

Protection.

35. There are two main alternatives on which it is necessary to decide before entering on a consideration of particular measures, namely, ***protection*** or ***repression*** A scheme of protection rests on the well-ascertained fact that one attack of the disease confers immunity from a second, and its aim is naturally or artificially to provide that cattle shall be so protect- [illegible]

abide by the vicissitudes of events

Opinions.

[illegible]

in the recurrence of the tion when it does occur Culna Animals known cted to the most severe protectiveness of one

Experiment.

attack may therefore be accepted as an undoubted fact But the mortality of the disease is equally indubitable, and, even under the most careful treatment, it is doubtful if it can be reduced below 20 per cent The question comes to be, then—Is at least 20 per cent of the entire stock of the country to be voluntarily sacrificed in order to secure protec- [illegible]

matters are best left as they are, though, were a system of universal induction of disease initiated, the occurrence of the disease would be brought under command, and it would no interfere with the use of cattle, b cause agriculturists would know what to expect, and would not be

OXEN.	Selections from Report of Indian Cattle
RINDERPEST	*embarrassed by unexpected loss of cattle during the agricultural season.* This consideration is a small one, however, compared with the certain loss of stock But the question has arisen—Can protection be conferred in any other way? Can the practice of vaccination be imitated, and a ... against the serious and ... he negative There ... *disease.* We have ... se produced by this ...
Conclusion.	supervision ... isolated and ... favourable circumstances Apart from the enormous establishment which would be necessary to carry out a universal system, whose cost would far exceed the losses of stock now accruing from rinderpest, it is ... found of any use The only protective plan of any promise is surrounding sound animals by an atmosphere of antiseptics—sulphurous or carbolic acid. *Mr. Crookes' experience indicates that this plan possesses* ...
Repression	... ed by instinct and imperfect knowledge, but that approved by the most careful consideration of the circumstances of the case All the methods by which a scheme of repression is put in force are passed in careful review in

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RINDERPEST.

successful in preventing the spread of cattle epizootic disease Examples of the benefit of measures of this kind are not wanting in this presidency Many cattle owners of Assam saved their buffaloes by sending them beyond the sphere of prevalence of the murrain The precautions adopted against the spread of disease in the Andaman Islands clearly saved the stock of the Settlement The measures adopted on a large scale at Nalla in the Sonthal Parganas evidently quenched the disease Illustrations might be multiplied and instances adduced of the

segregate, but

tions of this

out as to be fu

daily life and

order to carry

good purpose t

that a people so short-sighted and little prone to study the future as the natives of India should over estimate the palpable evils and under-estimate the possible advantages of restrictions Little can be expected from the people in the way of aid but much in the way of passive obstruction and neglect of the simplest, precautionary rules This has necessitated a recourse to law and the police, and persons in authority have had to take forethought for those whose interests are most concerned and compel them to action in accordance therewith

Necessity of legislation.

37 The question—Is recourse to law necessary?—has been amply discussed in the papers placed together in Appendix V The general impression is that without special legislation nothing effective can be done, and this coincides with the experience of Europe where this belief is emphatically declared by every country in an elaborate and minute code of laws or rules

Form of legislation.

38 Taking for granted the need of legal provision, the next question is—What form shall it assume? On this subject the Appendix in question contains much information The particular points on which we would place the greatest emphasis are,—

Early notice. Agency.

I—The duty of giving early notice Unless immediate notice of an outbreak is given, all future action is rendered less efficient This matter involves the question of what agency is to be responsible for initiating action, whether the owner the village headman, a special agency—pound-

OXEN.	Selections from Report of Indian Cattle
RINDERPEST.	keeper, etc ,—or t… existing and conv…
	land—the onus of carrying out means to save their own and their neighbour's cattle from disease Such a scheme would involve an immediate … headman or … repre- … , the
Segregation.	… first place to owners, who should be compelled to isolate their own s…k and segregate their healthy. How this is to be done is a problem not easy to … The reason … alleged for fa…ng to segregate was want … eopled and largely … e stock of an owner … seasons of cultiva- … ithout possessing a
	… on the … The … t con- … The … l when a large area is infected general stoppages of movements, regulation of …
Early action	… people must be practically taught segregation, and the plan most approved by experience installed as a village habit.

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Plague Commission, 1871. (*H T Pease.*) **OXEN.**

RINDERPEST.

III —When circumstances admit of it, there can be no doubt of the superiority of the plan of removing the healthy and isolating the sick, rather than simply removing the sick for isolation The Madras system

Treatment of sick.

IV.—The treatment of the isolated sick should be carefully carried out and either the people instructed in simple methods of doing so, or special agents made available for the purpose

[illegible]

Burial of carcasses.

The exhumation of the carcasses by dogs and jackals or wolves, or by chamars, might be provided against by sufficiently deep burial in the one case, and scoring the hide in the other; the responsibility of this measure would rest with the village headman, aided by the chaukidar

Disinfection.

VI —Disinfection, in the full sense of the term, would have to be carefully carried out all through, but fire is obviously the most effective and suitable

Killing

VII —The more serious, though efficient, expedient of killing is so antagonistic to the feelings of the people of India that we do not recommend its adoption in any case, even if the circumstances of the disease, as it prevails in this country—so common, so frequent, and so scattered—did not preclude its adoption.

Proposed scheme.

[illegible]

of contagium must
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ting on more strin-
the most extensive,
the necessity arises,
but as the kind and extent of measures used must depend on the circumstances and needs of the case, we would bar the adoption of any but the

O. 551-594.

OXEN	Selections from Report of Indian Cattle
RINDERPEST.	keeper, etc,—or the ordinary police
	question arises whether the zamindar should be the Magistrate's intermedia spector or sub inspector of police, or whether a special agency consisting of special district veterinary inspectors and a staff of salutries or pound-
	land—the onus of carrying out means to save their own and their neighbour's cattle from disease Such a scheme would involve an immediate
	-epre- , the
Segregation	first , and segregate their healthy. How this is to be done is a problem not easy to solve The reason universally alleged for failing to segregate was want
	The *t con-* The difficulty of the problem increases as the affected area is wider, and when a large area is infected general stoppages of movements, regulation of
Early action	
	people must be practically taught segregation, and the plan most approved by experience installed as a village habit.

O. 551-594

made to serve as a basis upon which the extent of [illegible] may be estimated

III.—As a means of exhibiting the fluctuations of [illegible] market prices of different kinds of stock should be period[illegible] in local Gazettes.

IV.—The systematic storing of fodder and jealous [illegible] pasture land where it exists, and its provision where it does [illegible] important considerations as regards the welfare of stock [illegible]

V.—Herding and droving cattle should be watched and [illegible] especially in times of murrain

VI.—Large fairs should be subject to skilled inspection and [illegible] precaution, and smaller fairs carefully watched, especially in [illegible] times

VII.—The hide trade is a source of danger, and should be watched and regulated In times of murrain, hides should be destroyed or thoroughly disinfected

VIII.—A law should be enacted for India regulating and restricting the sale of poisons

IX [illegible]

X.—[illegible] ary ch[illegible]

XI [illegible] prevent[illegible] any loc[illegible]

XII.—A veterinary school for the training of a native skilled agency should be organised

XIII.—Such skilled agents should be attached to municipalities and collectorates to investigate and report on murrains, and apply preventive and remedial measures

XIV.—A yearly summary of all the information which has been collected during the year regarding cattle murrains should be prepared and published, and the subject should constitute a point of attention in administration reports of provinces

XV.—The collection of such information and preparation of such reports should be assigned as a duty to some particular individual office or department

45.—It only remains for us now to express our sense of the unfailing courtesy and ready help which we always experienced at the hands of district officials in the prosecution of our inquiries and of regret that from circumstances beyond our power, we have not been able to present this report sooner Acknowledgments.

PRESIDENCY DIVISION.

Historical Sketch.

Cattle murrain attracted the attention of professional men more early and more strongly in Calcutta than elsewhere in Bengal, and though records and recollection do not extend its history back beyond one century, still we have in the work of Dr Duncan Stewart, Superintendent [illegible] PRESIDENCY DIVISION. Historical Sketch.

OXEN	Selections from Report of Indian Cattle

PRESIDENCY DIVISION
Historical Sketch

and the natives have with one voice declared that this is nothing new—has been told them by their fathers and grandfathers—has indeed become such a feature of rural life that it occasions neither surprise nor complaint Wherever the Cattle Plague Commission has gone in the pro-

a drought, a flood, or a cyclone producing such wholesale havoc and death that agricultural industry is for the time paralysed, and it needs a season or two of prosperity to repair the damage. The primary object of his investigation was to find a case of natural cow pox for the purpose of obtaining an indigenous source of supply of vaccine lymph. This same object led to the discovery and description of cattle disease in Hooghly Murshidabad, Sylhet, Saugor, and elsewhere, but the subject of the discovered disease was not in any other case so carefully followed up for its own sake as by Dr Stewart This gentleman with an admirable scientific instinct originated a very complete inquiry He visited the Calcutta byres and personally studied the symptoms and pathology of the disease, he carefully questioned those most likely to know as to the history and features of the plague, and had a searching inspection of the Calcutta slaughter houses and meat markets made The results of these steps will be found in the extract

1795-96 The earliest recorded date of any particular murrain is 1795 In that and the following year, according to Mr Blacquiere, one of Dr Stewart s informants, a great mortality occurred among men and cattle in the months of January and February. Another informant, Mr John Teil, a hide merchant and tanner, was familiar with the disease *Matah*,

1828 36 and wrote of its general prevalence in spring In 1836 Mr H Piddington, whose name and repute as a careful and correct observer are so well known in connection with the subject of cyclones, wrote in the *Transactions of the Agricultural and Horticultural Society (Vol III,*

with confidence

1843-44 This interesting paper leaves no doubt as to the identity of the disease or its frequent prevalence The outbreak of 1843-44 was a very severe one It commenced in September 1843 and lasted till June 1844, attaining a maximum in January The table at page 42 of this appendix shows the very remarkable parallel which obtained between this

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though the variolation of cows has been tried over and over again in India, no satisfactory results have ever been obtained

The subject of cattle murrain at the Presidency is now lost sight of until 1864 when two circumstances aroused fresh interest in it The first was a communication from the Government of Madras, regarding

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PRESIDENCY DIVISION

Historical Sketch.

cattle disease which prevailed in Karnul in 1863, drawing attention to the subject and asking for information The second and most effective cause of renewed attention was the breaking out of murrain at the exhibition held under the auspices of the late Lieutenant Governor of Bengal, Sir Cecil Beadon, at Belvedere in 1864 Then, as in 1844, inquiry revealed the frequent prevalence of epizootics, but the inquiry was now conducted on a more extensive scale, and embraced the whole of Lower Bengal, in each *district and division* of which murrain was found to be a subject familiar to the people and a frequent visitant The interest in the matter spread from Madras to Bombay and Burmah, and from Bengal to the North Western Provinces, Oudh, and the Punjab, and more recently to ... Still later ... plague with ... by Dr Palmer ... tment of the ... and facts ...

1857
1861-62-63.

ed were those which happened among the cattle of gentlemen and men of substance, who bred stock for pleasure or fancy, but the deaths ...

1861

... herford ... istrict ... it the ... error ... stricts ... papers ... pages 74-104)

As regards the other districts of the Presidency Division, the Com ...

oral testimony of the people, communicated to the Commission, and of district officials leaves no doubt as to the frequent prevalence of *basanto* or rinderpest, *puschima*, which is applied to severe forms of rinderpest and to hoven—a disease arising from eating unwholesome food, as well as *khura*, or foot and mouth disease

The ne... this division was in the Satkir... district, in the cold weather o... l continued to prevail in 1866 ... ease is said to have 1865-66.

O. 551-594.

OXEN.	Selections from Report of Indian Cattle

PRESIDENCY DIVISION

Historical Sketch.

caused great devastation among the cattle of several villages adjoining the Sundarbans The same form of disease (rinderpest) prevailed in J ter t nd b

1867. of t ly u be committing considerable havoc among the cattle of the agriculturists, and the description of the symptoms and *post-mortem* appearances leaves no doubt that the disease was rirderpest. This year was signalized in these parts by an unusually high inundation, and on its subsidence a virulent murrain broke out in the district of Nuddea A swelling of the throat and neck, and wasting are noted by the Collector, Mr. H Bell, as the most prominent symptoms of the disease, which appears to have been owing to the cattle eating submerged grass, but in the absence of a description by a skilled observer, it is difficult to pronounce decidedly on the type of this disease It appears to have subsided towards the close of the year

1868 In 1868 a very serious and severe outbreak of rinderpest occurred in the Diamond Harbour sub division of the 24-Parganas district This murrain has been carefully described by Baboo Hem Chunder Kerr, Deputy Collector, who was during that time in charge of the sub division, and by Mr H Farrell, V S, who was deputed in August to visit the affected tract and adopt measures, preventive and remedial, suited to the emergency

...ge of Bansburia, bullocks bought ...rly and westerly and August, and ...m this outbreak of cattle This ...e losses entailed notwithstanding

1869.

... There was also an outbreak at the ... sub-division of the 24-Parganas district in the commencement of the year In the Diamond Harbour sub division of the same district, rinderpest continued to prevail ... the close of the year beg... sub-division of the Nuc... pread, and attained a m...

1870. ...e Commission, who established their head quarters at Chuadanga, and from the 4th to the ...ns, and treatment of the disease. was found to prevail in most much interesting information as condition of agricultural stock, disease prevailed to a slighter

O. 551-594.

PRESIDENCY DIVISION. Historical Sketch.

extent in the Ranaghât and Bongong sub-divisions, and was subsequently reported to have subsided throughout the district in April. Rinderpest was found to prevail to a great extent in March in the Calcutta milkmen's sheds and evidence was abundantly obtained to the effect that frequently, or yearly, great losses of dairy and other stock from rinderpest occurred. There was a smart outbreak of this disease in some
in the Sathira s
and throughou
manner in the s

From Jessore, also, occasional reports were forwarded of limited visitations in the Jessore, Magura, and Bagirhaut sub-divisions, but nowhere, except at Chuadanga, did any widespread epizootic or serious loss of cattle occur.

Still later—in November and December—cases of "*guti*" were reported to occur in villages of the Khustea, Chuadanga, and Ranaghât sub-divisions of Nuddea, but the disease was scattered and its mortality slight

ORISSA DIVISION.

No early record of murrain in this division exists, and until the year

Tributary
and more
Mahanadi 1863.

are said to have been lost An epizootic occurred in 1864 in the district of Balasore, where the disease *guti* or *basanto* (rinderpest) was said to be "well known," and to prevail every two or three years and commit great ravages The characteristic symptoms of the disease are described by Dr. N Jackson, the Civil Surgeon

Murrain is stated by the Commissioner, R N. Shore, Esq, to have "shown itself very extensively" in the districts of Purí and Balasore in the same year. The Collector of Purí estimates that the stock of cattle in his district has been diminished one-half 1864

Up to 1869 no general outbreak of disease is reported, with the exception of an attack of foot and mouth disease, which occurred in 1866 among the artillery cattle in the station of Cuttack A letter was sent on the subject to the Bengal Government by the Commissioner, T. E Ravenshaw, Esq, in November 1866, which states explicitly that, with the except the recurrence 1866.

at Cuttack is 1868.
1869. He says — Thacker's Madras Reports, dated 31st March

"A telegram from the Commissary General on 18th November 1868 informed me that artillery cattle at C

"With regard to preventive measures of segregation, I have to report a complete success Your letter was received on the 29th November, and in a day or two afterwards the bullocks were divided as recommended by you After the separation of the cattle, one bullock only was taken ill and died in a few days Since this bullock was taken ill no other animal has shown any signs of disease whatever, and all those in detached parties have remained up to this time in a perfectly healthy condition"

Towards the close of the year 1869 disease broke out in the districts of Cuttack and Purí, and continued into 1870. 1869.

OXEN.	Selections from Report of Indian Cattle

ORISSA DIVISION Historical Sketch

In the former district the nature of the disease was not described, and was reported to be prevalent in nine villages of the Bargong Pargana Later reports show the prevalence of "cattle-pox" in September 1870 in seven villages of the Ramito and Utikun Parganas on the banks of the Nuna river

1870. In Puri the d sease was more widely spread and invaded several villages of five parganas Both rinderpest and foot and mouth disease appear to have prevailed simultaneously.

In this district also a September outbreak is described in twenty six villages of the Pargana Kodhar and Thannah Gope A later report, dated 13th October describes the prevalence of foot and mouth disease in some v llages of Pargana Kotdesh Balasore is reported to have been free from disease in 1870

It thus appears that both rinderpest (called *thakruni, basinto* or *guti*) and foot and mouth disease (called *phatua* and *chowa*, according as it prominently affects the feet or month) frequently prevail in the

omitted

DACCA DIVISION A very important and curious glimpse of an early history of cattle disease

by the

cow

are in

Society

As

subject of the present inquiry the following summary of these observations and experiments has been made —

1833 Dr Furnell Civil Surgeon of Sylhet, having read and become inter-

Plague Commission, 1871. (*H. T. Pease*) — OXEN.

DACCA DIVISION.

Historical Sketch.

A very interesting notice of *basanto* by Mr. Lamb, Civil Surgeon of Dacca, is contained in a letter addressed to the Superintending Surgeon of his Circle, on the subject of the regeneration of vaccine The following is an extract referring to cattle disease, from which it appears that the same disease prevailed in the same manner then as now :—

1836.

cover instances of its frequent co-existence with small-pox among the natives, and the disease is little known in town Among the cattle kept by the oil manufacturers or for milk last year, when nearly a thousand deaths from small pox occurred in Dacca, the disease only appeared in one muhalla, and for a short period, and I was not aware of its presence till it had ceased, after carrying off fifteen or twenty cows "

1860.

since then no cattle disease has appeared : the symptoms detailed are distinctive of rinderpest

Captain J F. Sherer writes, in December 1863, that no cattle murrain has ever existed in Cachar, but it will be noted that Mr. Brown states that murrain prevailed in Cachar in 1833 1863.

1864.

Mr C T. Buckl
districts of the
of Faridpur, whc
and that "there
cattle mortality
reporting on th
(8th July 1863)
sing (5th March
described by Cap
from the cold to
pox in man an
thousands of cattle.

[illegible] [illegible] of Indian Cattle

[illegible] a very severe and fatal outbreak occurred in the district of [illegible]. The disease was imported from the adjoining district of [illegible] across the [illegible]. It is reported to have raged in several [illegible] 1869, and appeared [illegible] The disease spread over the [illegible] and continued [illegible] to have [illegible]. The mortality in [illegible] Mr. Sutherland, at 20,000 [illegible] head died, of [illegible] Thana. Mr. Suther- [illegible] thousands of [illegible] given by the Civil Surgeon [illegible]

1868 [illegible] by a European gentle- [illegible] to the south of the [illegible] reports [illegible] August [illegible] among the cattle of Mymen- [illegible]

1868 [illegible] broke out in his district in the same months [illegible] in the Ab[illegible]dabad Police [illegible] September and October in Mula- [illegible] and Sherpur[illegible] Thanas, [illegible] The disease [illegible] up to May 1870, and a [illegible] that disease was still pre- [illegible] in the [illegible] of Mymensingh, disease broke [illegible] January 1870. A slight [illegible] in the [illegible] Pargana, in [illegible]

[illegible] reported to have broken out in [illegible] April and May 1869, and in [illegible]

[illegible] prevailed in the same [illegible]

[illegible] attention in this [illegible] exception of a report [illegible] Board at Calcutta [illegible]. The report was [illegible] in 1869 and 1870 [illegible] to which [illegible]. These [illegible] will be [illegible] the [illegible] records

[illegible] by the Commis- [illegible] to the effect that [illegible] from time [illegible] in any [illegible] I was [illegible] same

[illegible]

Plague Commission, 1871. (*H T Pease*)	OXEN.
	DACCA DIVISION. Historical Sketch.
sitlah	1836
ruary,	
bulloc.	
fifteen or twenty cows "	
	1860.
distinctive of rinderpest	
Captain J F Sherer writes, in December 1863 that no cattle murrain has ever existed in Cachar, but it will be noted that Mr Brown states that murrain prevailed in Cachar in 1833	1863.
Mr C T Buckl	1864.
districts of the	
of Faridpur, who	
and that "there i	
cattle mortal ty	
reporting on th	
(8th July 1863)	
sing (5th March	
described by Cap	
from the cold to	
pox in man an	
thousands of cattle	

OXEN.	Selections from Report of Indian Cattle
DACCA DIVISION. Historical Sketch 1865.	In 1865 a [illegible] Backergunge [illegible] Jessore across [illegible] villages on the [illegible] in the Perozep [illegible] Tugrah, Angaria, and Bishkhali Thana jurisdictions, and continued [illegible] ryots' From the careful detail of symptoms given by the Civil Surgeon Mr Bensley, it is evident that this murrain was rinderpest
1866	In 1866, Dr Brown, of Sylhet, was informed by a European gentleman that the disease was common about 70 miles to the south of the district Mr F B Simson, Commissioner of Dacca, reports (26th August 1869) that in 1866 a fatal murrain occurred among the cattle of Mymensing in July and August
1869	[illegible] November 1870
1869	In the Dacca District "small pox" is reported to have broken out in the Thanas Raipur and Rupganj about April and May 1869, and in the Thana Manickganj in March
1870	In March 1870 the disease is reported to have prevailed in the same locality.
BURDWAN DIVISION 1836.	[illegible] circulars, which are of considerable historical interest, are printed in the appendix, and the replies to them from other stations will be alluded to in the proper place. [illegible] prevalent during the Santhal insurrection (1855), and existed in some

BURDWAN DIVISION. Historical Sketch.

places at the time the letter was written In Bancoorah it had been virulent four years previously, in Burdwan had been known for 20 or 30 years, in Midnapur was reported to be a very common disease, in

though there is a universal tendency in the people of one district to ascribe the origin of cattle disease to some other Statements that the disease originally came from the north south, east and west are exceedingly common

Written records of particular outbreaks are as follows, oral testimony being disregarded as vague —

Cattle disease is said to have been very virulent in Bankura, but the particular localities affected are not mentioned 1860

Disease is said to have prevailed in the Sub division of Culna virulently in 1862 and in a milder form in 1863 Mr Stalkartt gives instances of its prevalence at Howrah and in the neighbourhood of Calcutta in both these years 1862 1863

All the 1864

in 1864, bu 1865

Shaculfpur, 1866.

during the y

at 4,500

The particular localities visited are not mentioned Disease also prevailed in the Sub division of Gurbettah, Midnapur District, in the latter year. In a report dated 6th January 1870, the Magistrate of Bankura states that the disease has existed in a mild form during the last three years 1867 1868.

Towards the end of 1869, however, this district appears to have been visited severely, and the outbreak which commenced then continued to prevail widely during the first seven months of 1870 A detailed statement was called for from each Thana in the district, which showed that only three of twelve police stations gave a clean bill of health In the remaining nine, a considerable mortality had occurred up to the 1869 1870.

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In Hoogh

OXEN	Selections from Report of Indian Cattle

BURDWAN DIVISION

Historical Sketch

Bashbarea, Bidyabati, Haripal, Kkanakul, Chanditola, and Jehanabad

In Midnapur a severe outbreak of disease occurred in June and July in the Sub division of Tumlook, but the remaining portions of the District seem to have remained unaffected From Birbhum a report was received in January, stating that *basanto* and *khura* prevailed in the south eastern parts of the district, but nowhere else

Towards the close of the year reports of murrain from the Burdwan District became more frequent The disease prevailed to a small extent and in a scattered way in the Bood Bood Sub division more severely in the Gangooria and Munglecote stations, south and north of Burdwan, and latterly an hospital for treatment was opened in the town of Culna east of Burdwan where numerous cases were obtained from the town and *neighbouring villages The Tumlook outbreak was reported on the 26th* of October to have disappeared In Hooghly reports were received in November of the prevalence of disease at Chinamur, but the cases were scattered and few

Bankura and Pirbhum appear to have continued free of plague throughout the rest of the year, no reports having been received subsequent to those above referred to

CHOTA NAGPUR DIVISION.

1836. A very interesting account of *matah* among cattle in this Division was elicited by the Medical Board in 1836. The account of it, written by Assistant Surgeon W Dunbar, shows that then, as now, an equally destructive murrain, apparently of the same nature, every two or three year ravaged the cattle of these districts

ttle diseases was first
missioner, Colonel E T
ell known in all the
numbers of cattle are
owever, is that given

by Lieutenant R C Money, Deputy Commissioner of Manbhum. He states that *basanto* is said always to have been in the district, and the
deat o or three
year In 1858,
1858 the id to have
suffe tartarized
antimony

1861. In the year 1861, 22 661 cows and 7,701 buffaloes are reported by Lieutenant Money to have died of *basanto* in Manbhum The mortality in the same district in 1862 is returned as 26 032 cows and 6,293 buffaloes The deaths in the year 1863 amounted to 18 098 cows and 54 459 buffaloes In the year 1864 many cattle are said to have died in this district, and in the Palamau Sub division of the Lohardaga District, where the disease called *sitlah* (rinderpest) is said always to prevail, "it increased to ar
(apparently a more virule
disease) co-existed Dis
extent, but in Palamau
"continued with very l
bhum was visited severel
22,000 The disease seems to have spread over the greater portion of *the district Matah* and *khura* are said to have been prevalent in the District of Hazaribagh during this year, but the particular localities visited are not specified, and in Singbhum rinderpest is stated to

(Margin: 1862, 1863, 1864, 1865, 1866)

O. 551-594.

have been very prevalent in the district A graphic description of the disease is given by the Deputy Commissioner, Dr W H Hayes CHOTA NAGPUR DIVISION.

No record exists of cattle disease in the Division in the years 1867 and 1868, but this, most probably, is owing rather to an absence of inquiry than to an absence of disease Historical Sketch. 1865 1866

Towards the end of the year 1869 *basanto* broke out in Purulia, and in the Parganas Ambicanagar and Simlapal in the Manbhum District, and very widely in the Hazaribagh District Cases appear also to have been observed here and there in Singbhum A very severe outbreak of *matah* is reported to have existed in the Palamau Sub-division of the Lohardaga District The disease commenced in February and lasted till June, and caused a mortality estimated at from 10,000 to 15 000 head of cattle Another disease, not named, characterised by watery purging, vomiting, and death in a few hours, exactly resembling cholera, is also reported to have been prevalent Small pox prevailed among men simultaneously with *matah* among cattle The officer reporting upon this outbreak states that cattle disease (*matah*) prevailed in the sub division during each of the five years preceding 1869 1869

The Manbhum and Hazaribagh outbreaks continued to attract attention during the early months of the year 1870, but the disease did not spread widely A few cases were from time to time brought to notice in the Singbhum District but the Commissioner writing in September, reported that the Division was free of disease 1870

In 1836, Dr K. Mackinnon, then Civil Surgeon of Tirhut in reply to ... nce of the PATNA DIVISION.

... Tirhut, in 1836

... murrain in 1845

... villages in

the Bhabua Sub division, whose evidence was recorded by the Commission on the occasion of their visit to that locality in June 1870, was to ...

from about 30 or 40 years, and mentions that the natives of the district assert that these diseases, as well as cholera, come from Bengal Mr Hope, the Collector of Behar, writing in 1864 states that small pox attacks cattle in that district every year, or every other year, most violently 'at the conclusion of the hot weather and beginning of the rains' Mr J J Grey Collector of Sarun, discovers in the same year that *matah* is frequently ...

1868

O. 551-594.

OXEN.	Selections from Report of Indian Cattle
PATNA DIVISION Historical Sketch 1859 1861.	Mr A. J Elliott, Collector of Tirhoot, mentions that 40 or 50 bullocks ... 1859 ... ry bad in the south east of the ... the prevalence of cattle disease ...
1862	... e ... y ... e herd will be saved Mr J Burke of the Pusa Stud, describes the symptoms of a disease which attacked the depôt bullocks in this year, which
1863	... had recently been very destructive in the adjoining district, and strongly advocates the employment of *kari nimack* for its treatment In the eastern part of the same district *matah* was severe in March and June, and one cattle-owner, Mr Curtis, of Ramcolah, lost nearly a third of his stock, another, Khaggee Ramsan Ally, lost upwards of a hundred head of cattle The symptoms related by Mr J. J Grey, the Collector, are most characteristic of rinderpest In another letter written in February 1864 Mr Grey states that the disease "last year seems chiefly to have attacked buffaloes ' Mr A. J Elliot, Collector of Tirhoot, reports in April 1864 that "last year *guti* appears to have been extremely prevalent in the north of the district" Foot and mouth disease attacked, in the rains of 1863, the cattle of the Pusa Stud
1864	... merous and ... l in the ... "*matah* ... he same ...
1865	...
1866	... 866 ... 1,822 to have died
1867.	From July to December 1867 both *guti and khura* (rinderpest and ... the Rhotasand Chainpur Parganas ... been imported from the Chainpur ... o have been attacked with *matah*

O. 551-594.

Plague Commission, 1871. (H. T. Pease)	OXEN.

From September to December 1868 *sitlah* is reported to have prevailed in the Rhotas and Sasseram Parganas of Shahabad. In Sarun 4,129 … to have been attacked with *matah*, and — PATNA DIVISION. Historical Sketch.

ed to be dying out in the Bhabua — 1868.

was again heard of in the Rhotas — 1869.

also cattle disease prevailed in the month of January, at Madhubani rinderpest broke out in March at the station of Dinapur among some cattle which had been bought in February at the Berhampur fair. In

1870.

prevail in several villages of the Patna District, but in a very scattered way, and in June se…

disease prevailed in …

ganas In Tirhut …

from the Khajauli …

BHAGALPUR DIVISION.

it closely resembles the epizootic described by … Other reporters confirm the truth of this remark, and the periodical appearance of murrain in various parts of the Division at intervals of one or more years is a well understood and acknowledged fact, while data are wanting to determine when this periodical prevalence first commenced The evidence obtained by the Commission in several villages around Purneah, proves that the appearance of disease stretches beyond the recollection of living men

The inquiries made by order of the Government of Bengal in 1864 elicited the fact that *chechack* or small-pox was a well-known disease … — 1864.

their several villages This practice prevails very extensively in India—

OXEN.	Selections from Report of Indian Cattle
PATNA DIVISION Historical Sketch 1859 1861.	Mr A. J Elliott Collector of Tirhoot, mentions that 40 or 50 bullocks died of *guti* in a factory in his district in 1859 In 1861 *matah* is said to have been very bad in the south east of the District of Saran
1862	herd will be saved Mr J Burke of the Pusa Stud, describes the symptoms of a disease which attacked the depôt bullocks in this year, which
1863	had recently been very destructive in the adjoining district, and strongly advocates the employment of *kari nimack* for its treatment In the eastern part of the same district *matah* was severe in March and June, and one cattle-owner, Mr Curtis, of Ramcolah, lost nearly a third of his stock, another, Khaggee Ramsan Ally, lost upwards of a hundred head of cattle The symptoms related by Mr J J Grey, the Collector, are most characteristic of rinderpest In another letter written in February 1864 Mr Grey states that the disease "last year seems chiefly to have attacked buffaloes" Mr A J. Elliot, Collector of Tirhoot, reports in April 1864 that "last year *guti* appears to have been extremely prevalent in the north of the district" Foot and mouth disease attacked, in the rains of 1863, the cattle of the Pusa Stud
1864	... merous and ... l in the ... "*matah* ... he same master, Dinapur, states that disease existed in that station in March 1864, and was carrying off large numbers He asserts that the murrain is ... pathic treatment
1865	... m to have flagged, ... onal villages of the ... to have been visited
1866	*Guti* continued to prevail in a scattered way in Buxar in 1866 and *dakuha* in Dinapur In the Sewan Sub division of Sarun, *matah* and
1867.	From July to December 1867 both *guti and khura* (rinderpest and ... the Rhotas and Chainpur Parganas ... been imported from the Chainpur ... o have been attacked with *matah*

O. 551-594.

Plague Commission, 1871. (*H. T. Pease*) | OXEN.

RAJSHAHYE DIVISION

Historical Sketch.

ingly selected some cows suffering under this malady, clothed them in blankets, and removing the crusts which he found developed on the udder on the 9th and 10th days of the disease, used these to vaccinate

sble discovery,' makes
This sagacious physi-
le of the cow was not
used instead of the crust, and remarks that the stages of progress of the pock were not minutely described We now know that if the case-

been accustomed to the more violent manifestations of variolous inoculation. In Calcutta the lymph soon became mixed up with that hitherto in use, and there is an absence of accurate detail as to its behaviour and results in other places. It was, no doubt, soon superseded by the regular supply, and it does not appear that, with the exception of the unfortunate Sylhet experiments, any effort was made at Murshidabad or elsewhere to repeat Dr Macpherson's practice.

The following précis of Dr Macpherson's proceedings is extracted from the "*Transactions of the Medical and Physical Society of Calcutta,*" in which these and other interesting papers received by the Medical Board on this subject are printed:—

Board's Circular,

OXEN.	Selections from Report of Indian Cattle
RAJSHAHYE DIVISION Historical Sketch Symptoms. Comparison with cow pox Inoculation of children Effects Protectiveness	*guti*; and on the 24th of August I was informed that several cows belonging to a
1833	The disease *matah* again broke out severely in Murshidabad in April 1833 The experiments above described were again tried, but *Dr Macpherson failed to obtain pustules* The mortality among *cattle* was great A child was inoculated from a pustule on the udder of a cow Slight inflammation of the arm ensued on the 4th and 5th days—no other result There was no coincident small pox among men, and no other animals were affected
1834 1835.	
1856 1860-64 1864	There now ensues a blank of 21 years in the history of cattle disease in this Division, but there is a distinct statement in a letter written by Mr R T Scott, "small pox" 8 years befor the same dist and has beer

O. 551-594.

1864 more careful inquiries were made regarding cattle diseases, and ...

... much to the same effect, some saying that they had seen ... on. The same ... is asserted to ... In Rajshahye *basanto* occurs at intervals of 2 to 4 years. In fact, the same tale is everywhere told in nearly the same words, and its burden is summed up in the expressions "periodical prevalence" and "great mortality;" and it is curious to observe here what is equally evident in other places, namely, that men, such as agents of estates, zamindars, etc., who obtain a more intimate acquaintance with the rural life of India, lay a greater emphasis upon this matter The experience of the Commission has abundantly affirmed the truth of this observation, and shown that, unless ...

1865.

...missioner, Mr. ... on the 1866.

1867.

better understood, that there is a tendency to doubt the propriety of calling them small pox This feature is very well illustrated in Mr. ...

upon here.

OXEN.	Selections from Report of Indian Cattle

RAJSHAHYE DIVISION

Historical Sketch 1868.

Two elaborate statements received from the districts of Rungpur and Dinajpur, showing the prevalence of cattle disease in each Police Division of these districts, evidence the wide prevalence of *basanto* and other diseases during this year, 1868 It appears also from a letter written by H C Wake, Esq, C B, Deputy Commissioner of Darjeeling, in June 1864, that the cattle of these districts are driven to graze in the [illegible] es, as in keeping [illegible] try from [illegible] is disease [illegible] in free association with each other, ar [illegible] return to their several villages, [illegible] is thus carried to places wher [illegible] these circumstances it is probal [illegible] escape being attacked with the disease, *and they thus acquire a protection which accounts for only a certain proportion of stock being in any one season seized with the disease* In 1869 disease continued to prevail extensively in Rungpur and Dinajpur, it also broke out in Bogra and Rajshahye in November, and in Murshidabad in December. This latter outbreak has continued to prevail and spread throughout this district up to the end of December 1870.

1869

1870

The localities principally affected have been in the Sadar and Jungipur Sub divisions

In Rajshahye also reports of a severe outbreak of *basanto* were received in June from the Nattore Sub division

In the district of Bogra the disease of 1869 continued to prevail during the months of January and February, and in the Dinajpur District reports received in April showed that the disease was still prevailing extensively, 678 head of cattle being noted as still ill when the investigation was made

NEPAL

Prevailing Diseases of Cattle

NEPAL.

Letter from Dr D Wright.

The following note on this subject has been communicated by Dr D Wright, Residency Surgeon at Katmandu It confirms the evidence recorded at Darjeeling with regard to Thibet, showing that murrains are common occurrences on these hills, and, moreover, adds another link to the chain of evidence which proves that the Tarai is a "home" of cattle plagues

"The diseases of the cattle here are six in number —

1 —*Sore mouth* —The animal is unable to graze, and saliva and froth flow from the mouth The disease is infectious In the first [illegible] that [illegible] the [illegible]

2 —*Foot* [illegible]

O. 551-594.

Plague Commission, 1871. (*H T Pease*)	OXEN.

there is merely watery diarrhœa, then *ganja*, salt, and *gur* are given daily in equal parts along with some rice. The dose of the mixture given is one tola weight. NEPAL. Historical Sketch

4 —*Khun ka bimari, blood disease* —The symptoms are,—flatulency and constipation, retention of urine, staring coat, and drooping ears The only treatment adopted is to give the animal the *ujmoda* or *jwain* plant to eat, which produces a discharge of urine and dung

5.—*Fever* —This is considered a fatal disease, and there is no treatment for it Buffaloes when attacked by fever are frequently bathed in a tank or river, and generally recover

6 —*Catarrh* —The treatment for this is the same as for murrain.

"The infectious diseases are generally brought into the valley by the herds of buffaloes and cattle that come from the Tarai and Bhutan

' The foot and mouth disease was prevalent during the past year, but just now the valley is free from disease"

In this, as in other Divis ons no precise date can be assigned to the first appearance of murrain among cattle, and the officials and inhabitants concur in asserting that plagues of various kinds have been of frequent occurrence, and that these occurrences extend beyond the recollection of the present generation COOCH BEHAR DIVISION

On this subject, Baboo Goonabhi Ram Burooah, Extra Assistant Commissioner of Gowalparah, writes,—" The oldest of men living cannot

rease of
spread
65, and 1851 52.
but in
ner of 1860

Darjeeling, mentions that in 1860 there was a great deal of loss of cattle from disease in the hills, and that it appears to have been imported from below (the Tarai) Surgeon J. C Collins writing in 1861 states that during the time that preparations were being made for the Sikhim Campaign in 1861, a very fatal disease broke out among the Commissariat cattle employed in bringing up stores from the plains This outbreak was described by several witnesses (Sikhim men) examined by the Cattle 1861.

ruminants

Rinderpest is stated by Mr Wake to have been prevalent in the Tarai in 1863 He also mentions that numbers of cattle of all kinds died of the 1863.

OXEN.	Selections from Report of Indian Cattle

COOCH BEHAR DIVISION

Historical Sketch

same disease Most of these came during the cold weather to graze, returning to Rangpur, Purneah, and Dinajpur at the commencement of the rains The next r ... in the evidence of Mr. John White ... Maldram, about 4 miles on the ... cha named

1864. Ramprost owned 150 head of cattle, and lost them all from a kind of dysentery. They passed blood, and the interior of the rectum was seen to be of a dark, bloody, liver colour "these cattle had no sore feet" Mr. Herrold, Manager of the Bullock Transit Train, finding that plain

1865. cattle did not stand hill work, sent men early in November 1865 to

...

the Duars and Cooch Behar, and that in the Eastern Duars it proved very fatal last year (1865) The Deputy Commissioner of the Duars reported that the carcasses of diseased cattle were to be seen in every village, and no precautions were taken to remove dead bodies

1866. Mr ... purchas ... and m ... them ...

... he cart-road spreading ... draught cattle, several ... ly natives in the vicinity of the cart road lost their buffaloes and cows I believe this disease is very common in Nepal, natives call the disease *dosalin*—plague" The Darjeeling Municipality now took over charge of the train lately under Mr Herrold's management, and at the depôt at Sonada a great many cattle died—in fact, so many, that the train was closed for a time. Mr. J White who had charge of this depôt, states that all the cattle ... lisease had prevailed

1868-69. ... severe in

1870. ... Sukna ... evious- ... d, and ... Kur- ... sion in ... se, the mortality was found to be very great on account of the contractors ...

Plague Commission, 1871. (*H T. Pease*) **OXEN.**

The statistics furnished by the Police are as follows :— **COOCH BEHAR DIVISION.**

Historical Sketch.

Locality.	Attacked.	Died.
Darjeeling	137	28
Kurseong	333	140
Mategarh	323	
Sonada	45	17
Phansigarh	43	2
TOTAL .	881	187

The mortality is about 21 per cent, rather less than a mean between the rates ascertained by the Commission to prevail amongst the cattle of contractors and private owners.

W Gordon Young, Esq, Commissioner of Chittagong, writing in January 1864, states that in the district of Noakhali cattle murrain frequently appears in September and October, and that in Tippera "it has been for many years past very destructive among the cattle" **CHITTAGONG DIVISION.** **1864**

In Chittagong, "where cattle are not numerous, no such murrain has apparently ever prevailed" The disease is called *basanto* and *Burrapera*

In Tipperah disease (*matah, sitala or basanto*) prevailed throughout the district, and in July and August attacked the cattle of the sudder station Commillah The detail of symptoms leaves no doubt that it was rinderpest. **1865**

Rinderpest continued to prevail very extensively in the district up to the month of September 1866 The mortality appears to have been very great, and type of the disease virulent. **1866.** **1868**

No record of the year 1867 has been furnished, but in 1868 rinderpest is said to have been very prevalent throughout the district of Tippera, and caused a mortality of 3,000 or 4,000 **1869.** **1870.**

The disease continued to spring up in different localities throughout Tippera, and the mortality is thought to have been even greater than in 1868 The district of Noakhali was also this year severely [illegible]

[illegible] I believe to be that the disease comes and goes, is virulent and mild at intervals in most districts"

In November a report was received from Tippera that *guti* (small-pox) prevailed [illegible]
report, dated [illegible]
after 169 cat[illegible]
informed that [illegible]
cattle had died

Mr Raban, Magistrate of Chittagong, reported, on the 17th October, that "small-pox" *was prevailing in the Chittagong District*, having broken out in September: 107 cattle had died among 130 attacked in a stock of 750 head

OXEN.	Selections from Report of Indian Cattle

ASSAM DIVISION.

Historical Sketch.

Subsequently, no disease was reported to prevail in the district, but this was afterwards explained to refer to the town of Chittagong This division was not visited by the Commission, because the reports received were too indefinite to undertake a long and expensive journey upon, but the papers appended to this summary will conclusively prove that the same diseases affect cattle in the districts of the Division, very much in the same manner as they do elsewhere in Bengal.

It is certain from the oral testimony of several inhabitants of Assam, obtained by the Commission on the occasion of their visit to that province, that cattle disease prevailed there previous to the British occupation This event dates from 1824, when Assam and its Dependencies were annexed to the British territories during the first Burmese war They were formally ceded by the Burmese by the treaty dated 24th February 1826 The ceded territory was attached to the Commissionership of the North East and P [illegible] Assam (the Districts of Lakhir [illegible] and Matack) was placed under [illegible] Singh, but in consequence of [illegible] adequately for the protection [illegible] inhabitants, and in consequence a [illegible] to [illegible] the stipulated tribute, the territory was resumed in 1838 After resumption it was administered by the Government of India in the Political Department, through the Commissioner of Assam and Governor General's Agent, North Eastern Frontier, till 1839 when by a proclamation, dated 31st July, it was annexed to Bengal The earliest murrain of which information could be obtained was that which occurred in the District of Sib-
1797. sagar in the year 1722, Sicabda (1797) This fact was communicated to the Commission by Babu Mohun Chunder Buroaah, Munsif of Dibrughar, who had heard the circumstance mentioned by his father.

Veterinary Surgeon Farrell writes in his report, dated the 2nd April 1870, as follows — "I came across an old Gossain who produced a book written in the Assamese character, and read from it that in the year
1818 1818 the Burmese invaded the country with a large army and that soon after their arrival in Assam a great plague broke out amongst the army cattle and destroyed them all, spread into the country, and committed similar devastation" The next notice of murrain is by Major Thomas Lamb, Deputy Commissioner of Darrang, who states that the first plague
1825 known in that district occurred in 1825, but that no detailed account of it is procurable A witness, Mohun Gossain, deposed that murrain existed in the district of Rangpur or Sibsagar 10 or 12 years before the English took over the government of that district (1838) Another witness, Gunga Nath Nath, Munsif and Subordinate Judge of Gauhati, while informing the Commission that a plague prevailed in Tezpur in 1848, said that his father, then a man of 50, told him that a similar plague had prevailed when he was a young man of 28 or 30 This again gives the year 1824 or 1826 He also stated that before the British rule there was no regular communication between Assam and Bengal The only cattle that ever came into the country were a few sent to the Assam Rajah by the Rajahs of Goalpara and Cooch Behar in the shape of buffaloes Another witness, Hood Gossain, aged 65, a resident of Lahowl, District Lakhimpur and a Government pensioner, told the Commission that cattle plague had occurred in the year 1830 or 1831 The next outbreak of which there is any record or recollection is that which took place in Darrang and Kamrup in 1848, 1849, and 1850 The murrain at Tezpur was witnessed by Colonel R. Campbell,

ASSAM DIVISION.

Historical Sketch

who says:—"In 1849 and 1850 plague attacked cattle at Tezpur, and so many cattle died that it was found impossible to remove them." In 1852 and 1853 a severe murrain prevailed throughout Assam. Mr. Grote, Secretary to the Board of Revenue, estimates the total mortality at 120,000 cattle. The symptoms and *post mortem* appearances of this plague were carefully described by Drs. Long and Maclean in the *Journal of the Agricultural and Horticultural Society, Volume XIII, page 270*. The disease is said by Dr. Maclean to have commenced in Kamrup in 1852, and gradually to have worked up the valley through Nowgong and Sibsagar to Lakhimpur. The Revd E. H. Higgs, a resident of Dibrughar, carefully studied the disease in that station in 1854 and 1855. He states that it was imported from Golaghat by a detachment of sepoys rejoining their corps at Dibrughar. He also states that at that time the natives informed him that the district was visited by murrain every 20 years, and that since 1855 it has prevailed more or less every year throughout the district. 1852. 1853. 1854. 1855

In 1864 the Commissioner of Assam reported upon the subject of cattle

1853.

was great mortality among cattle. From Kamrup the following report was received by the Commissioner:—"A cattle murrain, apparently similar to that mentioned in the correspondence," (Madras) "has been known in this district during the past eight years (1856-64) in the months of April and May and September and October." Cattle murrain visited the District of Darrang in the years 1860, 1861, and 1862, and the 1860 1861. 1862

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of Mungledai, Darrang, mentioned that during the monsoon of 1864 foot and mouth disease prevailed in the district, and Mr. Driberg states that this disease is very common in that district, but seldom fatal. Colonel Agnew's general conclusion in 1864 was, that disease had prevailed in different districts of the province at various intervals within the last 10 years. Colonel Hopkinson, writing in August 1866, states that in the Khasia Hills, and notably at Cherrapunji and its vicinity, a cattle disease was prevalent in August 1865, and showed itself to be very fatal. No reports of any epizootic disease among cattle had been received by him from the other districts since 1864. 1864 1865

Captain John Gregory informed the Commission that there was murrain among cattle in Nowgong in October and November 1866. A violent outbreak of cattle murrain took place in the western portion of the Darrang District, more particularly in the Sub division of Mungledai in 1867. The disease commenced in April and subsided in September. 1866. 1867

ASSAM DIVISION

Historical Sketch

who says:—"In 1849 and 1850 plague attacked cattle at Tezpur, and so many cattle died that it was found impossible to remove them " In 1852 and 1853 a severe murrain prevailed throughout Assam Mr. Grote, Secretary to the Board of Revenue, estimates the total mortality at 120,000 cattle The symptoms and *post mortem* appearances of this plague were carefully described by Drs Long and Maclean in the *Journal of the Agricultural and Horticultural Society, Volume XIII, page 270* The disease is said by Dr. Maclean to have commenced in Kamrup in 1852, and gradually to have worked up the valley through Nowgong and Sibsagar to Lakhimpur The Revd E H 1852 1853.

1854

1855

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1855.

similar to that mentioned in the correspondence (Madras) "has been

1860 1861. 1862

Mr J D Campbell, a Tea Planter that during the monsoon of 1864 1864 the district, and Mr Driberg states in that district but seldom fatal Colonel Agnew's general conclusion in 1864 was that disease had prevailed in different districts of the province at various intervals within the last 10 years Colonel Hopkinson, writing in August 1866 states that in the *Khasia Hills, and notably at Cherrapunji and its vicinity*, a cattle disease was prevalent in August 1865, and showed itself to be very fatal No reports of any epizootic disease among cattle had been received by him from the other districts since 1864 1865

Captain John Gregory informed the Commission that there was murrain among cattle in Nowgong in October and November 1866 A violent outbreak of cattle murrain took place in the western portion of the Darrang District, more particularly in the Sub division of Mungledai in 1867 The disease 1866. 1867

The loss according

OXEN.	Selections from Report of Indian Cattle

ASSAM DIVISION

Historical Sketch

1868

In 1868 severe murrain broke out in Kamrup The disease appeared with great severity in April, May, and June, and affected not only cattle, but also sheep, goats, pigs, and wild animals Dr Purves' description of the disease leaves no doubt that it was rinderpest It also prevailed at the same time in the Khasia Hills, and spread gradually into Central and Upper Assam, namely into Nowgong, Sibsagar, Darrang and Lakhimpur ... by the Commissioner and ... during the

1869 1870

years 1869 and ... districts of the Division ... akhimpur in March 1869 by a batch of Bengali buffaloes passing through the villages of Narainpur and Bangfang near the Dikrang river One of these buffaloes died of murrain close to the camp of the Deputy Commissioner The disease spread through the sub-division during the succeeding months before it had appeared in the southern part of the district The introduction of the disease into Dibrughar and its vicinity was precisely similar to the mode in which it was imported in 1854, namely by a detachment of sepoys rejoining the head quarters of the 42nd Assam Light Infantry from Golaghat, where the disease was raging This happened in June 1869 This Division was visited by the Commission in January and February An hospital was established near Dibrughar and systematic operations conducted A large mass of information was

gradually died out, and from the December reports it appeared that only a few scattered cases were occurring

PROVINCE OF OUDH

The Pro... ...r and ample as that

distinct instances of plague—in 1840, 1850, and 1859—were mentioned Here, as elsewhere, there are a great variety of cattle diseases known under different vernacular names, and it is difficult from the confused ... -d foot and ... known by ... *burri*, etc, ... g premised ... ivision will

SITAPUR DIVISION.

This Division forms the north western part of the Province, and comprises the Districts of *Hurdui*, *Sitapur*, and *Kheri*.

Plague Commission, 1871. (*H T. Pease*) OXEN

SITAPUR DIVISION

Historical Sketch

It appears from information supplied by Messrs Carnegy and Foy, who hold land in the northern part of the District of Kheri, that murrains are frequently prevalent in the breeding tracts of the Nepal Tarai. Mr. Carnegy states that in 1861 a plague among cattle prevailed, and, writing in 1870 he says that cattle disease existed annually during the past eight years in the neighbourhood of his estate Cattle are here herded in the same way as in the Darjeeling and Kumaun Tarai, and murrain ... when the ... of Nepal ... ion obtained ... ige 253) 1861

In ... was reported to exist in the Distric... were dying in the villages of the dis... ody purging and in some cases ... e made to segregate and cattle were ordered *not to be impounded*, in case disease might be spread ... the Ci... pest of this notes t... inquiry rad been made, and he was struck with the number of skeletons of cattle lying near them 1867.

... exist The Hardui d sease seems to have d ed out in Decem ber, it was called *murri*,—an indefinite term applied to any disease with much mortality.

... Kheri District in 1867 ... at murrain did prevail ... ctober ... cattle diseases prevail ... It is evident from the ... considerable mortality ... the d fferent diseases 1868

Cattle disease prevailed in the Sandila Tahsil of the District of Hardui in September 1869 having spread thither from the Mullhabad Tahsil of the Lucknow District across the Gumti river. The disease abated in October

In 1870 murrain seems to have prevailed in all the districts of the Division It broke out in Kheri and Sitapur in April, and periodical returns were received from these districts from July to December, showing that considerable losses of stock occurred These returns are given in a summary form in the sequel. In Hardui disease broke out in August 1870 Two forms of disease are described by Dr McReddie,—*barri*, under which name he describes the symptoms of rinderpest, and *khura* or foot and 1870

OXEN.	Selections from Report of Indian Cattle

FAIZABAD DIVISION

Historical Sketch

mouth disease Fifty two cattle had died on the 30th of September of 153 attacked in a stock of 775, or 7 per cent of stock and 34 per cent. of attacked.

FAIZABAD DIVISION.

This Division forms the north eastern part of the Province and com-

-prevailed
t are those
ures were
1867 id to have
d to the

1870 ıbad, and
district,

the losses were however small The figures given are as follows —

Place	Stock	No attacked	No died	No recovered	No still ill.
Sunkheri	106	29	17	12	.
Gurdaspur	60	16	4		12
Nasirpur	135	116	100	4	12
TOTAL	301	161	121	16	24

This gives a mortality of 40 per cent of stock and 75 per cent of attacked The symptoms assigned are those usually given—bloody purging, etc

In October of this year, the widespread prevalence of cattle murrain was reported from Bahraich The diseases prevailing were called *khang* and *gatarua*,—hoof and throat disease The symptoms assigned to the latter were so anomalous and suspicious that an inquiry was made as to whether cattle poisoning may not have been the cause of the deaths assigned to *gatarua* This was, however, answered in the negative The figures given in the reports received are as follows :—

Place	Stock	No attacked	No died	No recovered	No still ill	REMARKS.
Pyagpur and Puch derorie	216	181	28	141	12	*Khang*
Ch tramiror	254	112	54	29	29	*Khang* and *gatarua*
G'lawhe	201	31	23	5	3	*Ditto ditto*
Matabar		131	55	45	31	
S seyaralwan	455	194	79	28	87	*Ditto ditto. Khang.*
TOTAL	1,125	649	339	248	162	

RAI BARELI DIVISION. Historical Sketch

per cent of stock (taking
ent of attacked, 32 cases

printed below that 1,073
ent) in 47 villages of the
nt) in 219 villages of the
Nanpara Tahsil Though the foregoing information is subject to doubt as regards the type of the disease which prevailed, it is valuable as showing that great mortality took place in the district from murrain

No information has been received from the District of Gonda

Rai Bareli Division

This Division forms the south eastern part of the Province and comprises the Districts of *Rai Bareli*, *Partabgarh*, and *Sultanpur*

A return was received from Rai Bareli dated the 14th April 1870, in which 12 diseases of cattle are named and the statistics of 10 years given The cattle diseases named are marginally put down Rinderpest appears to be known as *haisa*, and foot and mouth disease as *khura*, for the rest it is impossible to identify them accurately The figures given are as follows —In a stock of 203 994, 25 095 were attacked (12 per cent), and 18 934 died (9 per cent. of stock and 73 per cent of attacked) Disease is said to have prevailed from June to September in each year 1859.

1 *Khura*—hoof disease
2 *Ghurka*—throat swelling
3 *Haku*— ditto
4 *Bitharu*—swelling of the jaws.
5 *Kharist*—itch
6 *Ba ruck*—swelling of stomach
7 *Chahan*—bleeding of the nose
8 *Haisa*—cholera.
9 *Medukt*—sores on the lip
10 *Baghi*—disease of the bowels
11 *Tulligana*—worms in the stomach

No specific record of disease exists until July 1869 when a great 1869.

In the District of Sultanpur also, *hulka* or cholera broke out in March 1859 in the Musafir Khana Pargana The statistics of one
n dated 7th
cent) and

extensively 1870
arded from
time to time are given in a summary form below Cholera—no doubt rinderpest—and foot and mouth disease are the two principal causes of sickness and mortality mentioned

Lucknow Division

This Division forms the south western portion of the Province and comprises the Districts of *Lucknow*, *Unao*, and *Barabanki* or *Durriabad*

The first official report of cattle disease in this Division is from Unao in June 1869 The mortality was very great and general, 83 per cent of the cattle attacked are said to have died The disease was called *sahurbad* and swelling of the glands of the throat is the only symptom mentioned The oral evidence obtained by the Commission showed that cattle disease prevailed in this Division long anterior to 1869 On the 1869

OXEN.	Selections from Report of Indian Cattle

UCKNOW DIVISION.

Historical Sketch

1st of ... that
cattle ... the
sympt ... and
burial ... nth a
further report was submitted, showing that disease still prevailed in Pergunnahs Mulliabad and Mahonah, 341 cattle had died out of 770 attacked, or 44 3 The disease is said to have died out in November

1870

In the districts both of Unao and Lucknow cattle plague continued to prevail throughout the year *1870* In *the former, the early reports* concerned the Safipur Pargana, but during the last half of the year disease seemed to have spread *all over the district. The murrain* was called *haiza*—cholera—because purging was the most prominent symptom, but there can be no doubt that rinderpest was the main cause of

cholera, dysentery or looseness, was spread widely over the district and caused very material damage No information has been received from the District of Barabanki

BENARES DIVISION

of murrain in the District of Karnul of that Presidency, and enquiring whether anything of the same sort had been observed within the jurisdiction of the Government of the North Western Provinces This letter ... Board of ... issioner ... should ... r officer ... Pearson, ... on the same subject.

In reply to this communication, the Sudder Board of Revenue submitted (20th April 1894) papers regarding cattle disease in Dera Dun, Jhansi and Lalatpur, which will be noticed hereafter. The reference

In June of the same year the Commissioner of Allahabad submitted to this Government reports regarding cattle disease in the District of Banda which were subsequently forwarded (14th July) to the Government of India, and will be found in the same volume at pages 205—207

Meantime reports had been received by the Home Department regarding cattle disease in the Hardui District of the Province of Oudh in November 1867 (Selections, pages 194—199). Copies of these docu-

BENARES DIVISION

Historical Sketch

ments were forwarded to the Government of the North-Western Provinces on the 8th February 1868, with a view to ascertain whether a similar disease existed in these Provinces, and whether the abundance or otherwise of salt had any effect upon the health of cattle This question was referred to the Board of Revenue, who issued a Circular, No B, dated 27th March 1868, to all Collectors This Circular elicited replies from all the Collectors of these Provinces, which were summarised by the Secretary on the 23rd July 1868 transmitted to the Local Government on the 22nd July, and to the Supreme Government on the 13th August

These replies which are printed in the Selections (pages 208—216), contain for most districts the earliest extant records on the subject of the diseases of cattle in them, and will be frequently referred to in these sketches This account of the development of information regarding cattle murrain in these Provinces has been written here once for all, and will be [illegible]

1868

revealed the existence of cattle plague in the years 1849, 1855 1857, and 1865

The Collect[illegible] whose symptom[illegible] a swollen app[illegible] prevailed in th[illegible] may have bee[illegible] to have been [illegible] in September and October 1869, eight different cattle diseases are said to be known in this district

The Collector of Azimgarh also reports that a good deal of cattle mortality had occurred on the confines of the Faizabad District It is worthy of note here that as will be more fully shown in Appendix 4 [illegible] District in [illegible] een in part [illegible] Collectors [illegible] disease had occurred in Pargana Zamanea, on the Shahabad side of the Ganges which was investigated by a farrier from the Karantadh Stud, and pronounc[illegible] the year [illegible] Benares [illegible] (Nos 17 [illegible] the distr[illegible] 1869 I[illegible] Benares [illegible] the exist[illegible] Sudder [illegible]

1869.

"A fe[illegible] there doe[illegible] considera[illegible] termed b[illegible]

BENARES DIVISION

Historical Sketch.

Tahsildars, and as a result of these a village-to-village inquiry instituted From these inquiries it appeared that the disease had broken out in October 1868 The Tahsildars had some difficulty in eliciting information from the people, but they found the symptoms of the disease to be,—hair standing on end, ears drooping, a sticky saliva from the mouth, distention of the stomach, frequent purging—first of watery then of bloody discharges—and death in from one to nine days after attack "

The remedies used by the people are specified *ghi*, the rind of *kodha*—a kind of gourd,—fomentation of the face with decoction of *nim* and pujas The latter had been performed by chamars for money received The Tahsildars were inclined to believe that many of the deaths were attributable to poisoning Mr Brodhurst goes on to say that on the 9th May he had seen cattle belonging to Rajah Sir Deonarian Singh suffering in the neighbourhood of Benares, from symptoms similar to those above described This he remarks could not be owing to poisoning because the chamars were not allowed to take the hides The Rajah had lost 13 cattle in Benares, and the same disease had broken out among his cattle on an estate near Syadpur, in the District of Ghazipur The Rajah's cattle were of superior breed and lived under good sanitary conditions, and succumbed to the disease, while the weaker and comparatively worthless were not attacked, or if attacked, recovered Cases of cattle poisoning had been brought to light in the district, and 27 persons had been [illegible] the poison used I [illegible] alleged chiefly from [illegible] few months The [illegible] ment at page 358, [illegible] probably exceeded one per cent of existing stock Proclamations had been [illegible] cat [illegible] of [illegible] cat [illegible] of March 1869 amongst a batch of cattle which had been purchased at the Kat Berhampur Fair, in the Shahabad District, on the 10th of February, and marched to Benares, arriving there on the 18th, 13 days before the disease broke out

Four cattle died on the 13th March these must have sickened some days before The matter was reported to the Officer Commanding the S[illegible]

suffering from [illegible]

[illegible] 18th of April They were inspected and found apparently healthy, and housed with the remaining cattle, disease however, broke out among them on the 22nd, four days after the introduction of the new cattle The disease died out on the 7th May after 77 had been attacked in a stock of

BENARES DIVISION.

Historical Sketch.

the plague.

Attention was now directed to ascertain whether disease had existed at the fair or along the road by which the cattle had marched It was found that a similar disease had broken out among 130 cattle purchased at the same fair and marched to Dinapur 10 died out of 30 attacked The Collector of Ghazipur reported that a "contagious fever" had prevailed among cattle in February and April at two of the halting

of disease in the Benares mation from other districts e was "very great loss of d partly to disease and partly to poisoning There can be no doubt that both causes were in operation The deaths were estimated by Mr Daniell, the Magistrate of the District, at 12 000 head, and it is very difficult to say how many were due to one or other cause. The impression gained by the Commission during their visit to this district was, that disease was responsible for the majority of deaths, and that here, as in other parts, poisoning was / cases of the all their losses

reported that 1870

poisoning were discovered, but the investigations satisfied the Collector that these were few in number, and even after stringent orders for burial were passed and enforced, deaths continued to occur as before given in ompanied udied the so much

made, and evidence taken, convinced them that it was the same form of disease which they had previously met with, namely, rinderpest, an

OXEN.	Selections from Report of Indian Cattle

BENARES DIVISION

Historical Sketch

opinion in which Mr Lemon after reconsidering all the evidence upon the subject, concurred The disease in this district appears to have died out about this time, and no subsequent reports were received The District of Jaunpur was visited by the Commission early in June, for the purpose of inquiring into the subject of cattle poisoning Efforts were made to discover the existence of disease, but without success Cattle d s-ease prevailed in the Ghazipur District in July and August, but not in a severe degree, and seems to have been put a stop to by a heavy fall of rain

The Magistrate of Azimgarh reports the prevalence of *chechuck* in some tahsils of the district in April, May and June The information given is meagre

In the District of Basti cattle disease is well known, and both rinder-pest, (*bh iwani*, etc) and foot and mouth disease are said to exist The latter prevailed in August towards the north of the district Hoven appears to be a common disease in the district, caused by improper

...*sively from March to November* ...es of Parganas Kuntil, Chunar, ...r number of the villages being ... are called *sitlah*, *rangwa*, and

what the other two names represent.

In the District of Gorackpur no official report of prevailing d sease was received , but from a private letter received by a member of the ... lisease (*khang*) and ... arly Other diseases ... nperfect descriptions

ALLAHABAD DIVISION, 1868.

... Division concerns an outbreak in the District of Banda in the year 1868 , but the oral testimony of the inhabitants of Hamirpur, Cawnpur, and Fatehpur, obtained by the Commission, is to the same effect here as elsewhere, ... from time beyond memory. ... The Collector, Mr M Sandys, ... d died The disease broke ... over the district

three other parganas Strict injunctions had been issued to isolate all diseased animals and prevent communication The disease was declining ... describes the symptoms of ... sing to take food or water, ... ourth day, liquid and bloody ... till the death of the animal ... ometimes the fatal issue was more rapid No successful treatment was known, the natives giving split gram soaked in water Mr Sandys writes —"Since the outbreak

ALLAHABAD DIVISION.

Historical Sketch.

the disease has appeared in 99 villages in this district The total number of cattle attacked has been 6,536, and total number of deaths 3 365, nearly 50 per cent. therefore have recovered "

He also describes *khura*, foot and mouth disease, which prevailed consentaneously A memorandum by Dr Ringer is appended, in which sulphur fumigation is recommended Dr Ringer had performed a *post-mortem* examination, and found the intestinal mucous membranes much congested.

The replies forwarded by Collectors to the Board of Revenue's Circular No B show that no disease was known to exist in the Districts of Jaunpur, Fatehpur, and Cawnpur. From Banda the information above summarised is given Cattle disease prevailed in Pargana Barah of the Allahabad District and its neighbourhood; up to 29th April 1868, 368 cattle had died. The symptoms described are—' loss of appetite, discharge from mouth and nose, and eruptions " Segregation was recommended In the Hamirpur District a disease similar to the Hardui disease had broken out, but the mortality was not great

1869.

The ...
North-W...
Allahab...
pur and
cattle in
Hamirpu...
Thornhill gives a good account of the murrain in reply to questions propounded by the *Government of the North Western Provinces* He states that the disease is always present in the district, but more ... towards the
... pread all over
... symptoms are

... casion of their
... nt of the disease in
... sequently forwarded
... with the Commis-

The mortality among cattle in the Jaunpur District was undoubtedly very great, and was mainly attributed o poisoning, but there can be little doubt that both starvation and disease had much to do with it A good summary of facts concerning loss of cattle in this district is given in Mr Crosthwaite's letter printed at page 362, and much more will be found in Appendix No 4. Banda appears to have been free from disease during 1869

1870.

...

in Kirwi at 198

The District of Hamirpur was visited by the Commission towards the end of April, and much valuable evidence was obtained regarding ...
... cases
... Foot
... aid to
... also,
... l past
... prevail

OXEN	Selections from Report of Indian Cattle

ALLAHABAD DIVISION

Historical Sketch

among the Government cattle The people were familiar enough with the usual diseases of cattle, but no exact information regarding recent or present disease could be obtained

From Fatehpur reports of an outbreak of disease early in March were received in May The district was visited on the 21st of this month, and many cases of rinderpest—*debí*—were seen and evidence recorded showin
a repo
this D
July a
recorde
this disease was

The Commission also visited the Jaunpur Distr ct early in June, in
e there
rmat on
re well
found

In August a report of the prevalence of murrain in the Pur and Manjanpur Muzahs of Pargana Cheyal of the Allahabad District was received A Native Doctor was deputed to investigate the nature of the disease Subsequently disease was ascertained to exist in the Karah Pargana, and on the 1st of September some cases were reported to have occurred in the Station of Allahabad It appears from the reports received that both foot and mouth disease and rinderpest prevailed simultaneously The report of the Native Doctor refers unmistakeably to the latter, while the Pol ce Officer who investigated the d sease descr bes the former The last report from this district is dated 6th October The d sease was still go ng on, but from the fact of no

AGRA DIVISION

many yea s

1867 68 The repl es to the Board s Circular B contain the earliest information on the subject Both in Mainpuri and Etah cattle disease, similar to

or fourth day This is what the experience of the Commission has taught them to call rinderpest Goats and sheep are also said to have suffered much In Etah the disease broke out about the close of the rains It was considered contagious The loss was roughly estimated in the Etah Tahsil at five head per village Sheep and goats also d ed in numbers In Agra, Etawah, Farackabad, and Muttra no cattle d sease had been observed

The next official record of cattle d sease is a report from the Farackabad District dated 21st February 1870. From this paper it appears that murrain had been prevalent in the district during the two previous years ... mortal ty noted was

1868 1869 1870

some parts of the
the symptoms were
those of rinderpest. On the 15th May the village in wh ch d sease was

O. 551-594.

Plague Commission, 1871. (*H T Pease*) | OXEN.

AGRA DIVISION

Historical Sketch

reported to exist was visited by the Commission Disease was found to exist there and in many neighbouring villages and to have prevailed in other adjoining parts of the district The people spoke of it as a familiar and frequent visitant

was told here as elsewhere

A report from the District of Etah, dated 20th August 1870, showed that *bedun* (rinderpest) was prevailing at that time Other diseases of cattle—among them, foot and mouth disease—were said to be of yearly prevalence

On the 16th of September the existence of a plague "of a virulent kind" was reported The symptoms assigned to it point to a severe form of rinderpest

On the 18th of October the disease was abating The mortality is put down at 1,384.

No further report was received from this district

The Collector of Mainpuri reported in August that there was no disease in his district

From Muttra a report was received in November to the effect that cattle murrain occurred in the district every year, but no specific information as to locality and mortality was given Foot and mouth disease and

MEERUT DIVISION

1862

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as far into
contained in
Circular B.

1867.

The Superintendent of Dera Dun reports that the disease prevailed in 1867 in two villages, one in Eastern and one in Western Dun. The same symptoms are assigned and the name *waha* given Well-conditioned cattle are said to be more liable to attack He states again that the people practise segregation

The Collector of Saharunpur reports that the cattle disease called *sir*, *rorah*, or *rorh* had been "unusually virulent" in his district during the latter part of the rainy season The mortality as given by the Tahsildars is marginally

Tahsils.	*No of deaths*
Saharunpur	2,499
Rurki	2 269
Deoband	12,408
Nakur	7,700
Total	24,876

for years past.

O. 551-594.

OXEN	Selections from Report of Indian Cattle

MEERUT DIVISION

Historical Sketch

The Collector of Mazafernagar states that disease generally occurs towards the close of the rains. The symptoms described are those of rinderpest In October 1867 about 10 per cent of the cattle of the district died

cattle suffer from "a species of influenza accompanied by diarrhœa." The Collector of Aligarh states that there has been no cattle disease in his district

The next series of reports regarding cattle diseases in this Division was elicited by the circulars and queries of the Commission The districts of Meerut, Bulandshahr, and Saharunpur were also visited by the Commission and much valuable information thus obtained

1870 In May 1870 the Collector of Meerut reported that foot and mouth disease had prevailed in March In June the Tahsildar of Haupper reported that disease had broken out a month before in the village of

mortality attributed to it showed that many of the cases must have been cases of rinderpest This surmise was verified by the Commission on the occasion of their visit to the district in July Fortnightly returns of the

...ing 1869 in August Jowala- rinder-pest and *sedh* or foot and mouth disease, but in the returns the two forms are evidently mixed up together, and their value is accordingly much impaired They show a mortality of 1,184 in a stock of 10,746, or 11 per cent The principal symptom assigned is dysentery. This district was visited by the Commission on the 2nd August and the disease *maind* or *rorah* identified as rinderpest Several cases were examined and animals examined *post mortem*

The Collect...
Ihurpuccaa n...
Parganas of...
Tahsildari, in...
May 1870. I...

O. 551-594.

MEERUT DIVISION.

Historical Sketch

cent) 369 had d ed (17 per cent of stock and 24 per cent. of attacked), 1 166 had recovered

The disease was considered infectious, and the symptoms ass gned are a mixture of tl ose of rinderpest and foot and mouth disease showing that both forms prevailed simultaneously

The disease was reported to have disappeared on the 22nd of July

A careful report on the subject of cattle diseases in the District of Mazafernagar is printed in the sequel sho ving that both r nderpest and foot and mouth disease are well known in the district and frequently prevail

The Superintendent of Dera Dun in a letter dated 25th November 18,0 describes *biradak*—rinderpest—and sore feet as the diseases of

ROHILKHAND DIVISION

contained in the lated 27th March than the repl es

1867 68.

in wh ch raged in most common in along the Ganges It was kno vn

partly that employed n foot and m th cases—poult ces of the leaves of *kikur k chnar* and *ag*, and n rinderpest—cakes of peas or rice flour soaked in oil

Tl October (1867 e d sease was in Oudh —rin among the h

A Parganas tells a tale of great mortal ty D sease commenced after the ra ns and cont nued t ll the latter end of January 1 68 The returns collected showed that in a stock of 46 880 head of cattle 12 221 or 26 per cent were attacked and 8 912 d ed or 10 per cent of stock and 73 per cent of attacked The symptoms are descr bed br efly as ntense th rst followed by bloody stools The an mal generally d ed on the third or fourth day after its attack The disease is stated to be *no r ew o ie* and s called *chera* Isolat on was pract sed and the cattle of the Tharu populat on who take better care of the r cattle were not attacked

The Collector of Budaun states that the d sease described in the Hardui D strict is a very common one and called *bedun*

The Collector of Shahjehanpur states that the d sease appeared in some villages of the Pargana Jellalabad from August 1867 to January 1868

In December 1868 a severe outbreak of disease occurred at Amsote in the Bijnor D str ct among the herds which were driven to graze there owing to tl e drought elsewhere An establishment was enterta ned

OXEN.	Selections from Report of Indian Cattle

ROHILKHAND DIVISION

Historical Sketch

1870

...isease by segregation, disease having disap-

...ime grazing grounds at ...t, in September 1870 The form on this occasion was *pukka* and *chupka* Other diseases had also prevailed in the jungles, and deaths had been numerous, rinderpest—*bedun*—was no doubt the chief cause of them

In the District of Shahjehanpur cattle disease prevailed during the first half of the year "in almost all the parganas and villages of the district"

No precise account of this prevalence has been received but the names ... at both rinderpest and foot and

... reported that disease—violent in and around Muza Ukka, ...n, and had broken out two months previously *In Ukka alone, in a stock of about 1,000 cattle 225* are said to have been attacked (22 5 per cent), and 200 to have died (20 6 per cent of stock and 91 per cent of attacked) The disease was considered infectious

On the 15th of August this disease broke out among the Commissariat slaughter cattle in the town of Bareli Measures of segregation were immediately adopted The affected cattle were removed and the unaffected divided into five lots, and kept apart at convenient distances, 55 were attacked and 32 died (58 per cent), the disease dying out on the 25th August Hitherto the symptoms had been those usually observed, violent purging, etc, but on the 20th the type changed · 27 cattle were ...e body, accompanied with constipa... ...ymptoms is ascribed to the cattle ... green grass, of the latter disease, ... by Dr Corbyn, and with apparent

[illegible]

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Mr

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it

stated that in June the cattle of that district had been affected with both *pukka*—foot and mouth disease—and *bedun*—rinderpest The evidence above summarised is thus conclusive as to both these forms of disease prevailing frequently, and sometimes with great severity, in all the districts of this Division

Plague Commission, 1871. (*H T Pease*) | OXEN.

KUMAON DIVISION

Historical Sketch.

1870

reports

CENTRAL PROVINCES.

CENTRAL PROVINCES

General Summary

1830

1867

Tahsili of the Nagpur District in December

Cattle disease prevailed slightly in Nagpúr in January and again in July In Bálághát, Taluka Badra, in January, April, and May, and in Chándá (Rajgarh Pargana and Mhul Tahsili) in February, March and April. 1868.

[illegible]

KUMAUN DIVISION

Historical Sketch

The Commissioner of Kumaun states, in his reply to the Circular of the Board of Revenue, No B, dated 27th March 1808, that "cattle disease is as well known in Kumaun as small pox among human beings" The disease is called *man*, and comes every year When it comes regularly, it is less fatal, but when two or three years have elapsed, it appears in a very virulent form, this *man* only attacks cattle once, and a *mantuar* [illegible]

[illegible]

traders from the lower country" This fits into the evidence collected at Darjeeling concerning the prevalence of disease among the cattle of [illegible]

[illegible]

ad been [illegible] rests of

The only information obtained from this Division in addition to the above is a letter from the Commissioner of Kumaun dated the 28th July 1870, in which it is stated that no disease prevailed at that time, but that *man* comes every year and has been always known in that part of the country There can be little doubt that this *man* is rinderpest, and it is to be remarked that foot and mouth disease is not mentioned in these reports 1870

CENTRAL PROVINCES

CENTRAL PROVINCES.

General Summary

[illegible]

1830

the natives distinguish by the same name which they use for variola, namely *matah*." This note is interesting as showing that, though detailed descriptions of murrains do not exist until very recently there can be very [illegible]

[illegible]

of the province The sources of information are, *1st*, short notes in the weekly returns of rainfall published in the *Central Provinces Gazette*, and 2nd, the replies from [illegible]

[illegible]

1867

July In Balaghât, Taluka Badra, in January, April, and May, and in Chândá (Rajgarh Pargana and Mhul Tahsil) in February, March, and April. 1868

OXEN.	Selections from Report of Indian Cattle
CENTRAL PROVINCES Historical Sketch General Summary	[illegible]
1869. 1870.	continuing [illegible] June has appeared [illegible] on the decrease. [illegible] especially among bu[illegible] August, September [illegible] a decline is noted [illegible] Cattle [illegible] April foot [illegible] the mortality is
1869.	[illegible] oh, *Seoni*, and [illegible] st, September, and October.
1870	In September cattle dise[illegible] some of the Khorai villages [illegible] this disease is again noted [illegible] pox" and disease of the hoof at Naraingunj in the Mandla District and the neighbouring villages is [illegible] for the week ending 1st Octobe[illegible] "At Ramgarh, early in Septem[illegible] disease called *patakna*—all fatal [illegible] head of cattle were fatally attac[illegible] (swelling of the neck) on [illegible] no fresh cases" On 8th [illegible] were fatally attacked by th[illegible] *on 25th September; of th*[illegible] since. At Deolapúr 10 c[illegible] [illegible]ber it is noted [illegible] ed and 9 re- [illegible] pox; no fresh [illegible] "30 head of [illegible] hey throw up [illegible] of information [illegible] ainy season of

Plague Commission, 1871. (*H T. Pease*) | OXEN.

District. Summary.

Sigur.—Two diseases called *ghorka* and *surka* prevailed in 1869

Mandla—An elaborate tabular statement is forwarded, showing that cattle disease prevailed extensively in the years 1869 and 1870 The following is a summary of it:—*Poka* prevailed in 1869-70 in Talukas Tholpur, Niwari, Manfi,

"the skin becomes scurfy and
bowels are severely purged
704 died of 748 attacked; 18

Ghurka prevailed in
Bambini, symptoms,—the
motion, and the animal refuses to eat and drink, duration three days, mortality,—in 1869, 56 died out of 62 attacked, 1870, 47 died out of 60 attacked *Brynga* prevailed in 1869 in Talukas Mutfurkat, Mudmi, Madequite, and Bijeygarh: symptoms,—gradual wasting away, dura-

mortality,—3 out of 7 attacked. *Chupka* prevailed in Taluka Ghugri in 1869 70 symptoms,—"there are ulcers on the tongue," duration four days, mortality,—1869, 23 out of 166, 1870, 15 out of 134 *Pokni*, diarrhœa, prevailed in Taluka Ghugri in 1869-70, mortality,—1869, 6 out of 78, 1870, 18 out of 62 *Chechack*, cow pox, prevailed in the same taluk in 1869-70, mortality,—1869, 7 out of 90, 1870, 4 out

The other diseases seem to be owing to improper diet and to hydatid cysts The deaths from all diseases amounted in these two years to 1,823

1870 Narbada Division—(Districts *Betul*, *Chindwara*, *Narsingpúr*, *Hoshingabad*, and *Nimar*)—Cow-pox is said to have prevailed in a few villages of Chindwara in September Cattle disease existed in some villages of the Chamoar Patha Tahsil of the Narsingpúr District in October, and a few cases of cow-pox are reported in the same Tahsil in November.

OXEN.	Selections from Report of Indian Cattle
CENTRAL PROVINCES Historical Sketch General Summary 1869	In Betul disease is said to have prevailed slightly in June In Chindwara no general disease is said to have prevailed since 1848. Seven diseases of cattle are described by the Deputy Commissioner, namely, *maindh* or *kukera, gurgura, panpriah,*—nature unknown, *matah* and *marri,* rinderpest, *bhowra* or *chucker,* and *tarack phasi,*—nature unknown In Narsingpúr small pox is said to have existed in May and June 1869 and foot rot at various times In Hoshangabad cattle disease
1868	
1869	
1870.	January it was prevalent in the Mungaili Pargana. In August about 200 cattle died of foot rot and small-pox in the Seoninarain ... Tahsil ... letter ... that during 1870 *bupra* (nature disease), also The Deput always prevail describes *mat* (rinderpest), a within the last year
1868 1869 1870	UPPER GODAVERY DISTRICT.—Cattle disease was reported in the Seroncha Taluk in December 1868 and in January 1869 In November a few cases of foot disease occurred In May 1870 some cases of cattle disease occurred
PANJAB.	The instructions of the Government of India (page 1) regarding the conduct of the inquiry into cattle murrains in Bengal did not originally indicate the Panjab as a field of observation or research Reports were, ... pleuro-pneumonia, called by the natives *shipri,* was a well known and frequently occurring disease of cattle, and had been known from time immemorial Cases were seen, *post mortem* examinations performed,

Plague Commission, 1871. (*H. T Pease*)	OXEN..

PANJAB. Historical Sketch.

and evidence led, which placed this on a basis of certainty Another disease, very fatal in character, called locally *bhukni*—a very intractable form of diarrhœa—had caused great losses of stock in some districts, Gujranwala and Jhang especially. This disease attacks cattle at the latter end of the hot season, when pasturage is hardly to be obtained and the water is scanty and foul At such a time the half-starved and debilitated cattle are doubtless attacked with diarrhœa, from eating rank or acrid herbage and plants, and drinking foul water

During the rains and cold weather the pasturage in the Panjab is generally abundant and very good, and at these seasons the disease *suth*—quarter-ill or black quarter—is not infrequently met with among cattle

Rinderpest, under the local names of *pir, vair, vah, vedun, sirak, bedun, mah, man, mowah, bara rog, sitlah, matah, andar-ka-matah,* etc, is unfortunately as well known here as in other parts of India Ample evidence was obtained of its actual existence in different parts at the very time of the Commission's visit Cases were seen and examined, and *post-mortem* examinations performed, which placed this beyond doubt, and the oral testimony of the inhabitants (who were always found to be most frank and open in their interviews and dealings) shows that rinderpest has occurred in the province from time beyond recollection Foot and mouth disease, called *dhaka kurag murag, laru, khura, khura phata,* etc, is also to be found among the cattle in every district Another affection of cattle was also found to be very prevalent among cattle, namely, cystic disease This malady has such an intimate relation to public health that the fact that cattle are in different parts of the Panjab, to a large extent affected by two forms of immature tapeworm—found in the flesh (tænia mediocanellata), and

stock, though there can be little doubt that, even putting the use of

be stated briefly in chronological order

Delhi Division—(*Districts—Delhi, Gurgaon, and Karnaul*).

Information regarding the districts of this Division is meagre, the town of Delhi was visited twice in July 1870, and a local investigation made on each occasion The result was that a sporadic case of rinderpest was found in the city. The disease is here called *rorah*. 1871

OXEN.	Selections from Report of Indian Cattle

PANJAB

Historical Sketch

The Deputy Commissioner of Gurgaon reported on the 12th of December 1870 that a disease had broken out in that district characterised by "looseness of the bowels, running from the mouth, and, after a ... t, death ensuing within ... e of a more explicit kind ... naul Stud in September ... mouth disease) had been ...

HISSAR DIVISION—(*Districts—Hissar, Rohtuck, and Sirsa*)

1810, 1830 brother, who was also a cow doctor, knew of *sirak* in the year 1810, and that he himself had since 1830 seen it attack the cattle in and near Hissar every fourth or fifth year It had not occurred there during the last three years

1864 ...

1866, ...

... ase of

1850 to 1869 ... years ... stock averaging 9 930 head, there is a yearly average loss of 1,439, or 14 49 per cent *Sirak, phiprl, goli* and *khura phata* are noted as causes of death of almost yearly occurrence

No information was obtained regarding the other districts of the Division

UMBALLA DIVISION—(*Districts—Umballa Ludiana and Simla*)

It is stated ...
of Ludiana ...
symptoms ...
1851 or thirteen ...
occur every two or three years

1870 *Mokh* or *manun* appeared in this district in March 1870 in the Jagraon Tahsil It became epidemic in that Tahsil, affecting 42 villages, and spread to the adjoining Tahsils of Ludiana and Samrala.

PANJAB
Historical Sketch

[illegible]

cent of attacked

In October of this year, rinderpest (*bararog*) and foot and mouth disease (*laru*) were reported to exist in the villages of Kotkhall and Kultina, in the Rajah of Keonthal's territory, in the Simla District Segregation appears to have been successfully carried out. No other localities in the district have been known to be attacked.

JULLUNDUR DIVISION—(*Districts—Jullundur, Hushiarpur, and Kandangra*)

In June 1870 foot and mouth disease occurred among the Commissariat slaughter cattle at Dharmsala. The disease appears to have been 1869 1870

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that *kurag murag* (f
in the Kulu and Plach

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AMRITSAR DIVISION—(*Districts—Amritsar, Gurdaspur, and Sialkot*)

The information obtained from this Division is full and interesting The inhabitants of the village Vadala, six miles from Amritsar, which was visited by the Commission in August 1870, stated that *manun*

[illegible]

1820
1840,
1860
1870.

the Deputy Commissioner are those of rinderpest In Gurdaspur also disease prevailed widely during the year Fortnightly reports from 1st September to 30th November show 1,107 deaths out of 4,102 attacked—26·98 per cent A variety of diseases are given, but rinderpest and foot and mouth disease are prominent among them.

OXEN.	Selections from Report of Indian Cattle

PANJAB

Historical Sketch

As early as March 1870, murrain broke out in the Daska Tahsil of the Sialkot District, at a place about half way between Sialkot and Gujranwala, on the high road: 2,327 cattle are reported to have died during the months March to July It was believed that the disease was brought from the Gujranwala District From the symptoms of the disease as described by Sub-Assistant Surgeon Futteh Singh, it appears that both rinderpest (*manun*) and foot and mouth disease (*mokhar*) prevailed simultaneously Fortnightly returns from 16th August to 30th November 1870 give a mortality of 3,112 among 3 914 attacked or 79 5 per cent

These returns were collected by Sub-Assistant Surgeon Futteh Singh who made a careful investigation into the circumstances of this murrain

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LAHORE DIVISION—(*Districts—Lahore, Gujranwala, and Ferozepur*)

1805 The district of Gujranwala in this Division holds a prominent posi-

inderpest and
adjoining A
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of 35 years
1861 was recorded
1869

a temporary village of huts is rapidly thrown up In seasons of drought both pasture and water are bad and the cattle are liable to a disease called *bhukni*, whose symptoms are incessant purging wasting and death

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begun in the Sarwal district, and spread thence into Gujranwala and Jhang, and in some cases the somewhat similar symptoms of *bhukni* and rinderpest were mixed up Rinderpest is said to have prevailed in

1870 Lahore in 1869 In March 1870 murrain was reported to have again broken out on the Gujranwala bar, but the disease seems to have died out in May Rinderpest and pleuro pneumonia were, however, found prevailing in August 1870, and evidence was obtained of the existence of the former in the month of April in Lahore Another outbreak of murrain was reported from the Kamoki Pargana of Gujranwala in September. It is supposed to have been pleuro pneumonia, and it is stated that 100

PANJAB. Historical Sketch.

head of cattle had died within 24 days in two villages named Ghora and Ude, a few miles on either side of the Gujranwala and Shekhupura

to have died. From the symptoms described by the Civil Surgeon, the disease appears to have been rinderpest.

MULTAN DIVISION—(*Districts—Multan, Jhang, Gugaira, and Muzaffargarh*)

1862, and rinderpest was seen both in the districts of Montgomery and Jhang, and its identity verified by *post-mortem* examination. The mortality from *bhukni* had been great. In the Chinote Tahsil 11,795 ... ed at R3,51,215. This disease was ... before the year 1867, but this is ... ng diseases of cattle was recorded ... Districts, and much accurate and ... e five common forms—rinderpest, ... ro-pneumonia, and black quarter—

RAWULPINDI DIVISION—(*Districts—Rawulpindi, Jhilum, Guzerat, and Shahpur*).

Information from this Division is scanty. A report received from Murree in August 1870 shows that rinderpest and foot and mouth disease are known in the district, but no facts regarding prevalence are given. In Rawulpindi rinderpest broke out among the Commissariat cattle in December. The symptoms and *post mortem* appearances were carefully studied by Veterinary Surgeon Moir.

No information has been obtained from the *Derajat* and *Peshawur Divisions*; but in the face of the evidence above summarised, it cannot be concluded that murrain is absent from these parts.

Cattle disease was also said to have prevailed in Usufzai in 1869, but no details were obtained from the Panjab Government.

MADRAS PRESIDENCY.

MADRAS PRESIDENCY.

The history of cattle murrain in the Madras Presidency is peculiarly interesting, because of the early notices which exist regarding cattle plagues; because in recent times the Madras Government took the initiative in investigating the subject, and stimulated an interest in the matter which has borne abundant fruits in other parts of India; because

OXEN	Selections from Report of Indian Cattle

MADRAS PRESIDENCY

Historical Sketch

here a skilled agency was first employed to inquire into the subject and devise measures for the prevention and treatment of disease causing mortality among cattle, because a legislative enactment was devised for these purposes; and because, after three years experience and continued attention to the subject by professional men and district officers, the application of the enactment so devised was authoritatively declared to be neither "expedient nor necessary," and the stamping out, limitation and treatment of murrains were entrusted to the knowledge, the personal efforts, and influence of individuals

These several points will be more fully brought out in the following remarks, which have designedly been made as brief as is consistent with clearness

1791 92 In 1791 92, severe murrain broke out among the cattle with the Army of Lord Cornwallis at Bunjator and Seringapatam. This fact is mentioned in a report by Dr J MacRae dated 11th November 1868, appended to Dr C Macnamara's work on Cholera

1811 In 1811 cattle disease prevailed among the cattle of the depôt at Hunsur It appears from the printed records (Selections from the Records of the Government of India, Home Department, No 69) that murrain was very destructive in Mysore in that year. In order to prevent the infection of the reserve cattle, these were parcelled out into

the neighbouring pastures,
kept in quarantine These
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reporting on the subject

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1848 In the year 1848 Dr William Gilchrist published his ' Practical Treatise" on the diseases of cattle, elephants, and camels This excellent work was founded on personal observation and study at the Hunsur Cattle Farm, and has been, up to this time, a standard work of

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MADRAS PRESIDENCY.

Historical Sketch

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1852.

The next notice of murrain is also from the training depôt at Hunsur. The disease is said to be the same as that described by Captain Harvey in 1811, and the same treatment, namely, frequent injections of a solution of sugar of lead into the nose and ears, applying alum water to ulcerated parts, and the use of camphorated oil, was employed "with the best results."

1863.

In July 1863 Captain T Nelson writes to the Collector of Karnul, describing a murrain which had prevailed in that district during the preceding three months, and had carried off hundreds of cattle. He states that this murrain reduced herds by half, and describes as the symptoms,—refusal of food, ears drooping, eyes watering, purging, succeeded by a bloody flux, an eruption of large pustules covering the whole body, and death between the fifth and tenth days. He proposes *inoculation* as a protective measure This letter is forwarded by Mr. J.

and consider and propose remedies.

This latter important proposal has not been so frequently adopted as

He says that the
virulent in the hot
water, and whatever
The symptoms de-
notes that the body
stules, and consider

ives in early stages,
e disease advances.
increase rather than

OXEN	Selections from Report of Indian Cattle

MADRAS RESIDENCY

Historical Sketch

here a skilled agency was first employed to inquire into the subject and devise measures for the prevention and treatment of disease causing mortality among cattle, because a legislative enactment was devised for these purposes, and because, after three years' experience and continued attention to the subject by professional men and district officers, the application of the enactment so devised was authoritatively declared to be neither "expedient nor necessary," and the stamping out, limitation and treatment of murrains were entrusted to the knowledge, the personal efforts, and influence of individuals

These several points will be more fully brought out in the following remarks, which have designedly been made as brief as is consistent with clearness

1791 92 ... he Army of ... is mention ... 8, appendec

1811 ... depôt at Hu ... from the Re ... 69) that mu ... order to prevent the infection of the reserve cattle, these were parcelled out into small portions, separated and distributed over the neighbouring pastures,

... he cattle in ... for Bellary, ... gh affected ... to proceed. ... iptain Harvey ... which has ... pe " Stimu- ... o have been ... ars to have

1848 In the year 1848 Dr William Gilchrist published his "Practical Treatise" on the diseases of cattle, elephants and camels This excellent work was founded on personal observation and study at the Hunsur Cattle Farm, and has been up to this time, a standard work of ...

Plague Commission, 1871 (*H T Pease*)	OXEN.

MADRAS PRESIDENCY.

Historical Sketch

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ommittees of
digest facts

adopted as
it ought, but the advantages of the measures are very apparent from the excellent results of the Benares Committee in 1869 (see Appendix,

given above They also move the other Governments in India to

He says that the
virulent in the hot
vater, and whatever
The symptoms described are those characteristic of rinderpest, he notes that the body may, in advanced stages, become covered with pustules, and consider the murrain more like plague than small pox

The treatment he recommends is,—slight laxatives in early stages, and salines cordials, and sedative astringents as the disease advances. He regards inoculation as dangerous, tending to increase rather than diminish the ravages of the disease.

MADRAS PRESIDENCY
Historical Sketch.
1864

The Government now appoint Veterinary Surgeon J Thacker to investigate and report upon the disease, and Mr Thacker contributes a valuable

cases treated at Ravipad (75 per cent) He prescribed the simple bazar drugs easily procurable by the people,—camphor, nitre, opium,

inoculation, he considers that it would only propagate a dangerous disease He finally recommends the employment of a qualified officer to interest the ryots in treating the malady, and see that necessary measures are carried out

The Collector of Karnul, in forwarding the report to the Board of

under him to acquire veterinary knowledge

The Board, in forwarding the above to Government, concur in the opinion as to the necessity of legislative action

In June 1864 Mr W G MacIvor Superintendent of the Government Cinchona Plantations, sends a careful report of murrain which raged in the Nilgherry Hills to the Collector of Coimbatore This report leaves no doubt that this murrain was a severe form of rinderpest,—an opinion recorded by Mr Thacker in a letter dated 12th July 1864 The Madras

Plague Commission, 1871. (*H T Pease*) OXEN.

valence of *kemari* or epizootic aphtha, among the cattle in the district (Coimbatore).

Mr MacIvor reports further in July 1864 that rinderpest broke out on the hill in August 1863 and proved most virulent not more than 2 per cent recovering He shows by personal experience *the superior efficacy of removing the healthy to removing the sick as a sanitary measure* In this opinion Mr Thacker concurs, pointing out at the same time the greater trouble and inconvenience of the former proceeding The next 1865.
notice of murrain is also from the hills Mr J Anderson, Assistant Apothecary, Lawrence Asylum Works, Loredah, gives a most interesting account of an outbreak of rinderpest which took place in the months of July and August The disease was imported from the plains by cattle which had been sent down to Coimbatore to fetch machinery One of *these* was attacked eight days after their return and thirteen others of the same lot were subsequently seized Of the first five animals attacked four died and only one recovered Mr Thacker's published directions for treatment were then adopted, and of thirteen attacked, four were saved in th

gruel, and

datura nitr

animal die

Coimbatore, states that the native cattle owners on the outbreak of this disease, "immediately drove away their cattle many miles distant"

The Collector of Coimbatore forwards these papers to the Board of Revenue, and remarks that a good many cattle had died on the hills from the effects of sore throat

Cattle disease (rinderpest) is next reported from Madamalai and 1866.
Munsicoil in the Sigur Valley among the cattle belonging to the Forest Department The disease broke out on the 24th December 1865 and out of 150 bullocks 31 were attacked, 12 died, and 19 recovered The treatment pursued was similar to that adopted by Mr Thacker,—chlorate of potash and gruel being given in the early stages, and opium and gruel in the later

Mr Thacker's next report is dated 2nd March 1866 He obtained personal experience of the disease in January at Ootacamund and was confirmed in his opinion that it was the true rinderpest of Europe He found also that the herds on the Nilgherry Hills had been periodically attacked with it but that no definite information was to be obtained

OXEN.	Selections from Report of Indian Cattle

MADRAS PRESIDENCY

Historical Sketch

In May of this year Dr Shortt submitted another report on cattle disease which prevailed in Mangalore and Yercand on the Shevaroy Hills in April 1866

He found that the disease was called *ummay* or small pox, and describes most accurately the symptoms and *post mortem* appearances of rinderpest from a careful examination of living and dead animals. He notes the ulcerated condition of the mucous membrane of the mouth and the congestion of the skin, and subcutaneous tissue causing a rough feeling of the skin Dr Shortt concludes that the disease so carefully observed by him is rinderpest He found the mortality in two herds of

The mortality was very great (14 per cent), owing to the owners of cattle employing sick animals for work, because of the scarcity in the number of these required for dr
of an outbreak of rinderpest i
He obtained 48 27 per cent of
The healthy cattle were picket
from each other, a quarter of a mile away from the sick, and the effect was to "modify the type, and eventually exterminate the disease" Re-
ot (rinderpest) and

II of 1866) in the
attle disease in the
ons of this Act is
provides for the
Magistrate of the

District, inculcates, under penalty, the duty of the owner to report to the pound-keeper attack by contagious disease, directs the pound keeper to examine the animal, order its removal to the hospital pound, and the disinfection of the shed in which it was kept, gives this official power to examine and inspect suspected animals and contaminated premises and act as circumstances demand, provides that the expense of food and treatment may be defrayed by the Pound Fund or owner,

MADRAS PRESIDENCY.

Historical Sketch

gives the pound-keeper power to destroy diseased animals when advisable; directs burial, and does not admit compensation, renders the levy of fees for care and treatment lawful, and sale of the animal to realise them; prohibits the removal of diseased or suspected animals without a license from the pound-keeper, attaches a penalty to disobedience of the pound-keeper's orders, or opposing the seizure of cattle under the Act; provides a remedy for illegal or improper seizure, places fees and fines to the credit of the Cattle Pound Fund; and gives the Governor in Council power to enact bye-laws more effectually to prevent the spread of disease.

1867.

whose success he writes in a very sanguine manner.

The next report is dated 12th September 1867. Mr Thacker was

deficiency of salt, and ameliorated by an increased supply of it. He found rinderpest (*vekkai*) prevailing at Pulloor, in the Madras District, and again put in practice, with success, the methods of segregation and treatment above described. The District of C

the disease from an infected

40 escaping the murrain by

mends the continued employm

on the various types which the

OXEN.	Selections from Report of Indian Cattle
MADRAS PRESIDENCY Historical Sketch	climate. In a letter to the Collector of Coimbatore, Mr. Thacker details measures by which rinderpest was stamped out among a herd of 50 buffaloes, by their being placed in isolated kraals The Board of Revenue and Madras Government accept these reports as satisfactory, approve of his continued employment, and request him to prepare a simple manual on the subject of cattle diseases in the Presidency, and their treatment.
1868	Mr Thacker's next report is dated 9th September 1868 He gives a narrative of the reports of cattle disease submitted to him, and his personal experience in localities visited by him; but as the paper is curiously void of dates, it is difficult to know when the outbreaks described occurred. He finds very virulent rinderpest on the Nilgherries, and once again confirms the propriety of segregating. At Kotergherry and Coonoor segregation and treatment were again adopted with apparent success At Hunsur an outbreak of *bara asar* was reported, but ceased before Mr. Thacker arrived He then visited North Arcot, and found rinderpest (*vekkai*) prevailing there A most instructive instance is noted of disease having broken out afresh, in consequence of measures for isolation having been relaxed Rinderpest was also reported from the Cuddapah District Coimbatore was again visited, and rinderpest found prevailing. His attention was next drawn to the Madras District, where segregation and treatment were again adopted with apparent success Disease continued to be reported from Salem, Coimbatore, consisting in separating the healthy cattle into detachments picketed at [illegible] 'ant from each other, treat- [illegible] the segregation for 15 days [illegible] people have confidence in [illegible] 186- In September 1868, [illegible]
1869.	[illegible]

O. 551-594.

Plague Commission, 1871 (*H T. Pease*) | OXEN.

MADRAS PRESIDENCY

Historical Sketch

estly deprecates the measure, the Collector of Coimbatore does not consider the introduction of the Act necessary, and considers that the

at present

Mr Thacker's next report is dated 1st October 1869 Cattle disease was reported from Karnul, Salem, Bellary, Nellore, North and South

quote near merly opted used.' The mortality is put down at 23 907 head, and the loss, at R20 per head R4,78,140 The murrain is called the Hassan District of the Ashtagram pest are correctly given and foot

rable rictly In the

1870

see the wholesome results of segregation

for the half year ending

30th attle disease in Malabar, Car Karnul, Madura, Secun dra of segregation, parcelling out herds, and treatment were adopted, and in all instances, when the plan was carefully carried out, with success Mr Thacker writes "Segre-

OXEN.	Selections from Report of Indian Cattle

MADRAS PRESIDENCY
Historical Sketch

climate In a letter to the Collector of Coimbatore, Mr Thacker details measures by which rinderpest was stamped out among a herd of 50 buffaloes, by their being placed in isolated kraals The Board of Revenue and Madras Government accept these reports as satisfactory, approve of his continued employment, and request him to prepare a simple manual on the subject of cattle diseases in the Presidency, and their treatment

1868 Mr Thacker's next report is dated 9th September 1868 He gives a narrative of the reports of cattle disease submitted to him, and his personal experience in localities visited by him, but as the paper is curiously void of dates, it is difficult to know when the outbreaks described occurred He finds very virulent rinderpest on the Nilgherries, and once again confirms the propriety of segregating At Kotergherry and Coonoor segregation and treatment were again adopted with apparent success At Hunsur an outbreak of *bara asar* was reported, but ceased before Mr Thacker arrived He then visited North Arcot, and found rinderpest (*vekkai*) prevailing there A most instructive instance is noted of disease having broken out afresh, in consequence of measures for isolation having been relaxed Rinderpest was also reported from the Cuddapah District Coimbatore was again visited, and rinderpest found prevailing His attention was next drawn to the Madras District, where segregation and treatment were again adopted with apparent success Disease continued to be reported from Salem, Coimbatore, North and South Arcot, and Cuddapah Districts, and an outbreak of

his medicine, and promises a manual

Mr Thacker's next report is dated 27th April 1869 In September 1868, he proceeded to Malabar, but found that cattle disease had ceased there ... Rinderpest ... Hills and on ... *chuppanivou* ... prevailed in the Sa' ... at ma ... North

1869. In ... rinderpest, but experienced some difficulty in getting his plan of segre-

MADRAS PRESIDENCY. Historical Sketch

estly deprecates the measure, the Collector of Coimbatore does not consider the introduction of the Act necessary, and considers that the people are ready to carry out measures for segregation and treatment, the Board of Revenue "recommend Government to continue the measures now in operation with so much success, in preference to appealing to the Legislature," and Government decide (24th June 1869) that the introduction of the Cattle Disease Act, or any similar enactment, is not called for at present

segregation were applied with energy and gratifying result

As an illustration of its appreciation by the people, the Board quote the instance of a herd of buffaloes which was attacked with murrain near Kotagherry, where Mr Thacker found that the people who had formerly been instructed in the system of segregation 'had already adopted it, the healthy cattle had been removed, and the disease soon ceased' Disease also prevailed in Mysore during the official year 1869 70 The mortality is put down at 23 907 head, and the loss, at R20 per head R4,78,140 The murrain is called *dod rogue*, and prevailed throughout the Hassan District of the Ashtagram Division The symptoms of rinderpest are correctly given, and foot and mouth disease is also said to be very common The next report from Mr Thacker is dated 31st March 1870 Up to the end of 1869 his attention was principally drawn to Karnul, Malabar, and Kandal on the Nilgherries.

In January 1870 murrain continued to rage in Malabar, South Kanara, and Karnul

The District of Nellore was visited and cattle treated with favourable results, 1870
as they
another
system,

MADRAS PRESIDENCY

Historical Sketch

The general inferences to be drawn from the experience in Madras are—

1 That rinderpest, known most commonly by the names *vekkai, ummai, bara azar, doddah rogue, kudinow, saraku*, etc, is a well-known and widespread disease in the Presidency, and has prevailed extensively since inquiries began to be made into the subject

2 That foot and mouth disease, swelled throat, black quarter, and

est strict segrega-

han removing the sick.

5 That by carefully conducted segregative methods the disease may be effectually limited to a certain locality or number of cattle, and its further spread prevented

upon the subject

8 That by persuasion, example, and personal influence the people may be brought to adopt the necessary measures of prevention and treatment

9 That the plan of protecting cattle by inoculation has not been entertained favourably, and all the thought and action adopted has tended to the opposite aim, namely, repression or stamping out.

The following are the forms (Nos. 1 and 4) which have been used to elicit written information of a more general or detailed description :—

FORM No 1.

QUESTIONS

12 Average duration of attack before recovery or death?

13 As to whether any preventive or remedial measures have been used or not, and with any success or not?

FORM No 4.

QUESTIONS.

1. Name of locality?
   Area in bigahs, acres or miles?
   Geography and nature of soil?

Plague Commission, 1871. (*H. T. Pease*) | OXEN.

Form No 4

2 Number of cattle in the locality, and number to square mile?
3. Different breeds of cattle in the locality?
Average value of cattle per head?
Now and 10 years ago?
4 Uses for which cattle are employed?
I.—Agriculture, how and when?
Bullocks or cows employed?
II.—Draught and burden?
Treatment of cattle so employed?
III.—Dairy?
Proportion used for each purpose?
5 Mode of housing?

6

7 ny seasons?

8. for pasture to other districts?
If so, whither and to what distance?
9 General condition of cattle?
10 Stock how kept up?
I.—By breeding?
Special bulls kept?
II.—By importation?
Whence?
A erage pr e ned ?

11.

12. se?
13 ot?

14.
15 History of plagues?

16
17.
18

19 Statistics of cattle plague?
Proportion per cent of attacked?
Proportion per cent of recoveries?
Proportion per cent of deaths?
20. Kind of cattle most liable to attack with regard to
Breeds,
Age,
Sex, and
Condition?
21 Symptoms?
Shivering?
Appetite and rumination?
Skin, temperature, hair, eruption, etc?

O. 551-594.

OXEN.	Selections from Report of Indian Cattle

orm No 4

Posture of animals ?

22 If body examined after death, what appearances ?

23 Opinion of reporter as to contagiousness of different varieties of cattle plague ?

24

25

Separation of s ck and healthy ?

26

27

28

29

30 Effects of weather and heavy falls of rain ?

31 Any other remarks on points not above mentioned ?

THE ANDAMAN ISLANDS

Historical Sketch.

The insular position of this Settlement, its comparatively recent occupancy (1858), and the accurate history which has been kept of all events which have transpired there since then, render the study of any cattle plagues which may have happened extremely interesting The same remark applies to cholera whose outbreal s in this island have been recorded by Dr C Macnamara in his well known treatise on Asiatic Cholera It is very clear that cattle disease was not *indigenous* u the Andaman Islands, because there were no cattle there among which the disease could originate, and as will appear from the sequel, disease did break out among cattle on more than one occas on, and then was stamped out by

1864-65 is

anc

where the best grazing was to be found Guinea and *dub* grass were being planted to improve the pasture

1865 66 Three hundred and twenty seven head of cattle and 3 697 sheep were imported from Calcutta and British Burmah during the year There was mortality amoı g sheep twice in July in the height of the south west

1866 67

year, and several new sheds constructed A new farm was opened out at Perseverance Point. The cultivation of Guinea grass continued successful, but *dub* grass is not mentioned All the slaughter cattle were

Plague Commission, 1871 (*H T Pease*) | OXEN

THE ANDAMANS.

Historical Sketch

mortality among them is very heavy, and sometimes it increases to a very high rate The very hot and the very wet months are particularly baneful to them, added to this the voyage from Calcutta has a most

goats and poultry

1867 68. The cattle farm at Perseverance Point is noted as a success, and the

1868 69

spread among the horned cattle here, had it done so the loss would have been very great, and the advance of the Settlement towards becoming independent of foreign meat supplies much retarded Fortunately, by the exercise of much vigilance, the disease did not extend, and in future great care will be observed in preventing communication between newly arrived cattle and those already here' Dr Rean has forwarded the report of the Committee which was appointed to investigate this matter, which is full and interesting

In his annual report for 1869, Dr Rean remarks as follows with regard to the stock of the Settlement —

" *Sheep* —In former years the mortality among sheep on ship board and after their arrival here was very great, but during the past year much improvement has taken place *more care has been exercised in selecting a finer class of animals and greater precautions taken on the voyage They are well housed on arrival* and the experience now gained in their management seems sufficient to secure an immunity from any great loss among them for the future

* * * * * * * * * * *

" *Pigs* —These animals thrive remarkably well and increase greatly."

1870 In the Annual Administration Report for 1869 70 a census of stock *on 1st April 1870 is given, namely*, 858 cows, 264 male calves 340 female calves, 2 240 goats, and 729 pigs, 129 cows were sent to the Nicobar Islands and *were doing exceedingly well It* is noted that wild buffaloes exist in the latter—"the produce of some cattle left here by the Danish settlers" In April some cattle received from Calcutta introduced an epidemic of foot and mouth disease, from which three of the imported cattle were suffering. It will be observed that the existence of this disease

O. 551-594.

OXEN	Selections from Report of Indian Cattle

THE ANDAMANS
Historical Sketch

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on
seven casualties had occurred, which in a stock of about 1,400 gives 4 per cent —a considerable loss

In the report for June it is noted that the health of the cattle had improved, and that only some of the weaker had yielded to the disease, *20 deaths are noted*

The foregoing notes have been gleaned from the Administration Reports, and indicate the value which would attach to a more detailed history of the introduction of horned stock, and subsequently of disease, into these islands It may fairly be concluded that the two forms of murrain observed in the Andamans—rinderpest and foot and mouth

---

CEYLON.

Summary of the Report of the Ceylon Cattle Disease Commission.

Summary of Report of Cattle Disease Commission

Though the Government of Ceylon is distinct from that of the continent which it adjoins, and events occurring there may be considered

excellent report which was drawn up on this subject, so as to bring the

very common in the island The
consisted of a Civilian a Medical
aha Mudliyar Its constitution was
ndian Cattle Plague Commission
and the report is dated October
1869 Six journeys were made to different parts of the island, the conditions under which stock existed examined, their diseases studied, and the evidence of natives, planters, and officials recorded regarding these

Plague Commission, 1871 (*H T Pease*) OXEN.

CEYLON

Summary of Report of Cattle Disease Commission

Written statements and mortuary returns were also called for and obtained The inquiry was therefore practical and complete, and the information recorded is ample and intelligently placed in the general report The Commission enter rather fully into questions connected with cultivation, care of stock breeding, pasturage, housing, etc As compared with Bengal, their descriptions exhibit a vastly inferior picture with regard to each of these particulars, and they show convincing cause for energy in the way of improving agriculture and stock As regards *diseases* of stock, they found rinderpest and foot and mouth disease very

[illegible]

[illegible] and cyst di ease, which have been so pointedly described on the continent of India

As regards the *history* of murrains, the Commission could not trace out any early record, or fi[illegible] oral evidence that murrai[illegible] concluded also that up[illegible] but that since that year[illegible] quency and violence and[illegible] may have been owing to the rapid extens on of coffee planting and the more active importation movement, and more intimate association of cattle consequent thereon

As regards *mortality*, they note that during the three years ended 1867 the average reported yearly loss was not less than 70,000 head, [illegible] and that cultivation is ser ously impeded in numerous instances, owing to loss of cattle by disease It also appears that coffee cultivation is in Ceylon depriving cattle of pasture land, as rice cultivation is in Lower Bengal The effect of drought and bad grazing is prominently dwelt on as predisposing to murrain

The *contagiousness* of both forms of murrain is accepted as an indisputable fact, and a principle upon which preventive measures must hinge The various means and modes by which the disease may spread are also enumerated

As regards *treatment*, preventive treatment is assigned the most prominent place Isolation, segregation and disinfection, are the main features of the plan proposed The primary agent of this repressive system is the village head man to whom, under penalty for neglect, immediate report is to be made, he is to take immediate steps on assuring himself of the necessity in the way of preliminary separation The agent of the district is to be informed at once, and on him will rest the burden of future measures, provided the early steps have been imperfect or ineffectual.

OXEN.	Selections from Report of Indian Cattle, etc

CEYLON

Summary of Report of Cattle Disease Commission

The hospital treatment recommended is an early dose of salt and sulphur, carbolic acid water, "frequent feeds of thick rice congi" and [illegible]

expiry)

2. No cattle to graze on crown pastures without license

3 No bull above one year old to be allowed to graze on public pasture ground

4 Castration by the European plan.

5 Owners to report sickness to head man who inspects, segregates, and reports to agent

6 Locality to be placed in quarantine and cattle movements through it prevented

7 This restriction to be removed only by Government agents or competent authority.

8 Hospitals, medicines and keepers to be provided and appointed

9 Owners to pay for keep and treatment

10 Tavelams to be subject to inspection and restriction if necessary

11 Rules suitable to each province to be made by the agent and proclaimed

12 Finally, the appointment of a special officer with suitable qualifications, and the training of a special native agency to put these principles into practice are recommended.

The foregoing is a brief sketch of the Ceylon report, which, *mutatis mutandis,* reveals very much the same conditions as regards stock and their diseases as the foregoing pages The conclusions and recommendations are therefore valuable aids in arriving at a solution of the great problem of prevention The report differs from the Madras reports in giving only results of inquiries and suggestions as to future action, and no record of any action adopted or work done This should undoubtedly be the object and burden of all future records of contagious murrains among cattle.

G. I C. P. O —No. 1398 R & A.—17-11-95.—2100—W. B. G

O. 551-594.

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr George Watt, Reporter on Economic Products to the Government of India, Calcutta

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions Contributions or corrections and additions will therefore be most welcome

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry in the Forest Series Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series

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This sheet and the title page may be removed when the subject matter is filed in its proper place according to the letter and number shown at the bottom of each page

OXEN	Selections from Report of Indian Cattle, etc

CEYLON

Summary of Report of Cattle Disease Commission

The hospital treatment recommended is an early dose of salt and sulphur, carbolic acid, water, "frequent feeds of thick rice congi" and counter irritation in throat cases

The advantage of giving discretion to local agents who know the circumstances of the district is indicated, and a legislative enactment is recommended, having for its objects—

1 Quarantine for new arrivals (14 days, and a license to travel at its expiry)

2. No cattle to graze on crown pastures without license

3 No bull above one year old to be allowed to graze on public pasture ground

4 Castration by the European plan.

5 Owners to report sickness to head man who inspects, segregates, and reports to agent

6 Locality to be placed in quarantine and cattle movements through it prevented

7 This restriction to be removed only by Government agents or competent authority.

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O. 551-594.

THE

AGRICULTURAL LEDGER

1896—No. 9.

TERMINALIA CHEB

[*DICTIONARY OF ECONOMIC PRODUCT T. 325.*]

ACACIA ARABICA.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol.*

CASSIA AURICULATA.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. II., C*

TANNING MATERIALS.

rief Statement of the Imperial Institute Inquiry (No. 48 in the Repo Collections for 1895-96), showing progress made up to June 15th, 189



CALCUTTA:
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA
1896.

of THE AGRICULTURAL LEDGER are :—

The⸱ information connected with agriculture or with economic products
hich will admit of its ready transfer to ledgers,

(1) To
tenance of uniform ledgers (on the plan of the Dictionary)
in a form in agricultural subjects throughout India, so that

(2) To secure the es made in any report or publication may be
in all offic ices where ledgers are kept,
referenc ion, in convenient form of information on any subject
readily riculture or economic products to officials or other persons

(3) To admin in,
con onnection between all papers of interest published on subjects
in to economic products and the official Dictionary of Economic

(4) To cts With this object the information published in the Ledger will
rmly be given under the name and number of the Dictionary article
hich they more especially amplify When the subject has not hitherto
been dealt with in the Dictionary, the position it very possibly would occupy
in future issues of that work will be assigned to it.

(Vegetable Product Series, No. 22)
(Dyes and Tans)

THE
AGRICULTURAL LEDGER.
1896—No. 9.

TERMINALIA CHEBULA.
[*Dictionary of Economic Products, Vol VI, Pt IV*, T 325]

ACACIA ARABICA.
[*Dictionary of Economic Products, Vol. I*, A 101]

CASSIA AURICULATA.
[*Dictionary of Economic Products, Vol II*, C 741]

TANNING MATERIALS

Brief Statement of the Imperial Institute Inquiry (No 46 in the Report on Collections for 1895-96), showing progress made up to June 15th 1896.

Tanning Materials.

This inquiry (No 46 in the Report on Collections for 1895 96) may be said to have commenced
dated 18th January 1894 which
Tanned Skins and submit ed an in
Rutherford & Co of Madras

The investigation assumed greater interest and importance however with the letter No 48 F S dated the 8th June 1895 from the Imperial Institute, by which Sir Frederick Abel intimated that the subject of Tanning Materials had for some time past engaged the attention of the members of the Research Department, and that "the results obtained vary very considerably as regards the proportion of tannin in one and the same product. In some instances this may be due to the conditions under which the materials have been grown in the different Presidencies, in others, possibly, to the variation in age of the plant from which the samples have been taken Thus in the case of **Cassia auriculata** from Cuddapah, Madras, the proportions of tannin range from 7 to 11 pe
examined by Mr Proctor of
as much as 18 per cent
Chebula, supplied from M

T. 325.

fru ts are from he same t ees (a) The trees flower in April, and the
September, and the
ts, both half ripe and
of my house, and left
there till dry I shall be glad to hear the result of the examination of the Myrobalans

and Burma —

Note No. 46 of 1895-96.

Circular Note.

Collections for the Imperial Institute, London, and the Indian Museum, Calcutta

Tanning Materials.

proposed to conduct investigations dur ng the present year with three tanning substances *viz* —

Terminalia Chebula,
Acacia arabica, and
Cassia auriculata.

I. Terminalia Chebula.

Dictionary of Economic Products, Vol. VI., Pt. IV., T. 325 348.

following way —

S x local ties should be selected in d fferent parts, the places selected being such as to fairly represent climatic and soil variations In each

Circular Note.

for (a), (b), and (c)

One individual tree would not probably afford a very large number of fruits, but it is believed that e chemical analysis. To still f maturity, a large quantity of should be collected from a number of trees, not from an individual tree. Each specimen should be put in a separate bag bearing a separate number A note should accompany the specimens containing the following information :—

(a) Nature of each specimen and the kind of tree from which it has been collected.
(b) Date on which the specimen is collected and the locality where the tree grows
(c) Estimated quantity of the fruit annually available, time of the year when available, and the price at which it can be delivered at the nearest railway station or port.

II. Acacia arabica.

Dictionary of Economic Products, Vol. I., A. 101-134.

With Acacia arabica it is proposed to deal with the bark mainly. As in the case of Terminalia three kinds of trees should be selected in one and the same locality, *viz*, (a) young, (b) fairly mature, and (c) old. The bark from these trees should be collected in the following months :—

(a) In January.
(b) In March, when the tree is in flower.
(c) In May or June, when the ripe pods are on the tree.
(d) In September, when the sap begins to ascend.

Each specimen should be separately kept, labelled and numbered. A descriptive Note should accompany the specimens, containing similar information as in the case of Terminalia Chebula.

III. Cassia auriculata.

Dictionary of Economic Products, Vol. II., C. 741.

Of Cassia auriculata the bark should be obtained from a selected number of localities, and the collection should be of such a nature as to exemplify the effects of the age of the plant, season of gathering the bark and local peculiarities of the region of production. A descriptive Note like that required for Terminalia Chebula and Acacia arabica should accompany the specimens.

The chemical exam [illegible]

Mr. Proctor was found to contain as much as 18 per cent. It is hoped that the investigation now set on foot will once for all decide the question as to the cause of this difference

It is not necessary that the experiments with the three products mentioned above should be made in every Province. The following distribution of the work is, therefore, suggested :—

Terminalia Chebula experiment may be made in Bengal, Central Provinces, Madras and Bombay

Acacia arabica in Bengal, North-Western Provinces, Punjab and Sind.

Cassia auriculata in Madras, Bombay and Berars



With his letter No 14—68, dated the 1st January 1896, **Sir Frederick Abel** forwarded copy of a Memorandum by the Senior Assistant Chemist in the Research Department of the Imperial Institute on the subject of the examination of Indian tanning materials In that letter it was pointed out that the Memorandum gave numerical results obtained with **Terminalia Chebula, Acacia arabica, Cassia auriculata, Alnus nitida,** and **Ceriops Roxburghiana.**

The Memorandum may be here given as it contains much of practical interest to the Tanning Industries.

Some Indian Tan-Stuffs.

By R L. Jenks, F C S., *Chemical Assistant in the Research Department*

Memorandum on some Indian Tanning materials

Th ... be remarked, is rich in trees and ... materials of great variety, and in ... part, unknown to the markets of ... the *Myrobalan*, which is the fruit of one or other of the three species of **Terminalia** Specimens of many barks, quite unknown or unused in this country, were exhibited in the Indian and Colonial Exhibition of 1886, and a fine series of samples is to be seen in the Indian Court of the Imperial Institute collections Although the reputation of these barks as tanning materials is thoroughly estab- ... is empirical The amount ... unknown and, in the case ... his point has been obtained ... that the results of analyses made of a few specimens of which the history is unknown, may be rather misleading than instruct... tar ... to ...

life, but it certainly appears to have this distinguishing character—that it is constantly passing away, in the plant, from the seat of formation, *viz.*, from the leaves and green parts which are exposed to light, towards the interior of the plant, where it is believed to assist in the development of nitrogenous bodies True waste products, on the other hand appear to be transmitted towards the deciduous extremities, and so get rid of. Tannin is consequently a somewhat fugitive substance in the plant;

TANNING
Materials

Brief Statement of the

moreover ... that of f ... , , uits, etc , collected ... , u c u ghly charged with the astringent principle, may, at times, be almost void of it The commercial consequence is obvious, and it may easily happen that the ... practical value of a tan stuff of recent ... t, may be entirely ru ... collected under exce ... to obtain accurate in ... nt, yielding that na ... chemical examinatio

As a fir ...

... e published, both as ... d because they are in s ... that are known to have

... n account of the gene ... amination of these tann ... ground to a fine powe ... drug mill A quantity of this powder sufficient to give about six grams of extractive matter per litre of liquor was accurately weighed out A thistle funnel was bent twice at right angles so as to form a siphon, the head of which would just touch the bottom of a beaker of about one litre capacity The thistle-head was covered with fine m ... band and placed into the beak ... o inches with fine sifted sand (pre ... rochloric acid), so that the thistl ... sand A half litre of distilled water was placed in the beaker, and the powder having been added, it was allowed to stand for some hours, the outer limb of the siphon was then lengthened to some five feet, by the attachment of the requisite tubing, and the siphon was set slowly working; when the liquor had been drawn off a further quantity was added, about one litre, being sufficient to extract the tannin thoroughly from the powder, but if more appeared to be required a further quantity of about 300 cubic centimetres was added, this was afterwards siphoned off separately and concentrated by evaporation unt ... extract did not exceed one litre T ... , Parker and Proctor* have shown th ... traction for myrobalans is between ... , but the earlier experiments in the Research Department were made before the publication of their work, and it was not considered advisable to alter the conditions in these comparative experiments The total weight of the extractive or soluble matter was determined by evaporating 100 C C in a weighed basin, for which purpose round bottomed nickel basins, 3 inches across, were employed. A convenient water-bath was made by fitting to an ordinary 8-inch saucepan a flat lid of sheet copper with four holes of 2½-inch diameter cut in it The basins were supported over these on glass rims made by cutting rings from the body of a chipped or dam... beaker The tannin in the extract was est ... , the "shake" method, inv lved shak ... e, a measured volume of the tan liquo ... purified hide-

* Journal of Soc of Chem, Industry, July 1895.

T. 325.

separately by ignition in a platinum dish.

The following results were obtained :—

Description and No.	Ash %	Total Sol. %	Non Tans %	Tans %	Remarks
Terminalia Chebula—					
No. 1093	1·3	54·71	15 77	38 91	Round and [illegible]
" 661	1·7	32·80	19 50	13 30	Small, dried, and [illegible]
" 662	1·91	43·36	24·91	18 45	Long, lean, [illegible]
" 357	2 14	46 70	19 68	27 02	Small, shrivelled, [illegible]
Acacia arabica, *babul* pods	...	33·73	24·18	9 55	Husks and seeds.
Cassia auriculata—					
No. 6154	1·03	17 37	6·08	11·29	From small [illegible] about 1-inch diameter.
" 678	2 97	16 55	16 31	0·24	Root bark.
" 6152	0 82	11 63	4·65	6 98	From young shoots
" 6151	0·36	15·18	4 96	10·22	From stems 3 years old
A sample furnished by Mr. Proctor	0 91	18 53	2 21	16 32	
Alnus nitida	0 2	7 63	4 56	3·07	Very short-grained bark
Ceriops Roxburghiana	0 74	14 88	4 52	10 36	From boughs about 1 inch diameter.

Terminalia Chebula.—It will be seen at once that the variations in the percentage of tannin found in the four samples of this material is very great. [illegible] onary of Economic Products [illegible] dian and Colonial Exhibition [illegible] and it was then shown that [illegible] those of oval and pointed [illegible] nd solid in structure, while [illegible] Dr Paul undertook to make [illegible] supplied with three perfectly [illegible] ound to vary in these from 7 to 33 per cent, and the order of value assigned to them by the practical expert was justified by the analyses. It was generally agreed that the tannin in different samples might be expected to vary from 6 per cent to 33 per cent, but the important work of collating external appearance or age of the [illegible]

est [illegible]

ma [illegible]

cor [illegible]

in [illegible]

TANNING Materials — Brief Statement of the

been bro ght nder he n t ce of he Ind C

Acacia arabica

Acacia arabica —Both the bark and the pods of this tree the well known *babul* contain tannin An early analysis of the pods shows that the husk or cases alone contain 60 per cent of tannin and the seeds themselves practically none The sample of pods examined in the Research Department contained only 9½ per cent, while two specimens ent and 13 per cent were not separated nor operat on upon a large) per cent of tannin is known defin tely of its tannin hab t

The Indian Government has arranged to gather a complete series of samples of this bark at four periods of the year and from old and young trees.

Cassia auriculata

are recorded for comparison, but it is not proposed at present to deal exhaustively with these particular materials

For the purpose of convenient reference in connection with the collections that have been made or which have been arranged for, the following *précis* of correspondence may be here given the marginal numbers being the registration numbers of the collections received up to the 15th June 1896 —

Terminalia Chebula

TERMINALIA CHEBULA

Bombay —The Deputy Conservator of Forests NORTHERN CIRCLE replied (letter No 3127 dated 17th December 1895) that Terminalia Chebula is found in insignificant quantities only in one Division and that hence he regretted he could offer no assistance

This was acknowledged (No 743—61) by asking in the event of the people in the Northern Circle Bombay using any other special tanning material whether the Conservator would be prepared to furnish a supply for analysis. It was explained that the chemical examination of a small sample of *Hirda* (Terminalia Chebula)

would be of value, even though commercial results might not be anticipated BOMBAY

The Conservator of Forests, CENTRAL CIRCLE (letter No. 5910, dated 17th December 1895) stated that he was prepared to undertake the preparation of the collections indented for

The Conservator of Forests, SOUTHERN CIRCLE, replied (letter No 6154, dated 7th January 1896) that **Terminalia Chebula** occurs very extensively all along the Ghats and about 2 200 tons of the fruit are collected annually. He added that it was impossible to procure the required fruits before November next as these cannot be dried in sufficient quantity before the beginning of the dry season The Conservator suggested that it might suffice if fallen nuts were Existing Trade.

as necessary to examine the fruit from different localities What is

framed in order to solve chemical difficulties and were made at the request of the home chemical authorities, that the results of the inquiry might be of purely chemical interest or might have a very

mentioned by him In reply the Conservator in his letter (No 7533, dated 5th March 1896) promised to meet the indent to the best of his ability

The Divisional Forest Officer, Belgaum (SOUTHERN CIRCLE) wrote (letter No. C 406, dated 7th March 1896) that the season was too far advanced to collect the required information, but he would do his best in November next and that meantime he would collect specimens of the flowers. The same officer wrote (letter No G 65 dated

Central Provinces—The Conservator of Forests SOUTHERN CIRCLE, Nagpur, replied (letter No 527 M, dated 18th December 1895) CENTRAL PROVINCES.

CENTRAL PROVINCES

that he would endeavour to collect the desired specimens. He re-

asking that of two maunds collected of each form, one maund might be exposed to rain, in the exact way pursued by the natives, in order to determine the results of bad curing, but that the other maund should

N.-W. P. & OUDH.

North-West Provinces and Oudh.—The Conservator of Forests, OUDH CIRCLE, by his letter No. 1084 C, dated the 19th March 1896, reported that he had addressed the Forest Officers of Kheri and Bahraich and requested them to take early action.

By his letter No. 551, dated 31st March 1896, the Conservator of Forests, CENTRAL CIRCLE, replied that none of the trees producing these materials are found in quantity in that Circle.

The Conservator was informed (No. 1149—61) that the chemical

ripe fruits should be sent.

Acknowledged by letter No. $\frac{2132}{41}$, dated 14th July 1896, in which he was asked to supply 10 seers of the over ripe fruits.

The Conservator of Forests, SCHOOL CIRCLE, replied (letter No. 1314, dated 16th March 1896), and promised to do his best, but suggested that the experiment might be carried out in a locality where the tree is common, since in that Circle the fruit is collected and used locally only.

61, dated the 30th March) by desired the fruits to be fur- ible, so that the influence of tannin might be tested. This was replied to by the Conservator in his letter No. 9 dated the 7th April 1896, in which he pointed out that the North West Provinces were not included originally in the list of localities from which specimens

MADRAS.

were required, but that he would endeavour to procure a supply as desired.

Mr Ince.—The Conservator of Forests, Central Circle [illegible]

R C 1226, dated 30th January 1896) reported that he had taken steps to procure the collections. In his opinion the variation in value of myrobalans is due to the careless way in which the fruit is gathered. Much is collected in a green state, by lopping the branches and the fruits at once dried in the sun, again, large quantities are gathered up more or less charred after forest fires. In wet districts, such as Malabar, the fruit is often damaged by rain The best specimens would doubtless come from Nellore, where the Yanadis, a forest tribe, collect the fruit for Government

The Conservator was thanked for his interesting letter (reply No. 387—61, dated the 25th February 1896), and informed that while the irregularity in collection of myrobalans is possibly the chief defect, it is not yet known whether unripe or ripe fruits are the richer in tannin It is desired to be able to say whether the green fruits gathered from the trees are better or worse than the ripe fruits collected from the ground.

The Acting Conservator of Forests, SOUTHERN CIRCLE, replied by his No 2326, dated 11th May 1896, that he had asked the District Forest Officer, Madura, to arrange for the experiments with **Terminalia Chebula.** He also enclosed the following return from the District Forest Officers of the Circle reporting the estimated yield of fruits in their Districts —

ABSTRACT OF RETURNS FROM DISTRICT FOREST OFFICERS OF THE ESTIMATED YIELD IN GALLNUTS

Estimated Production

South Canara.—The quantity of Myrobalan exported from ports during the last five years was as follows —

Year.	Whither exported	Quantity. Cwt.	qr	lb
1890-91	[illegible]	4,037	2	0
1891-92		3,041	1	14
1892-93		1,743	0	0
1893-94		2,344	1	0
1894-95		1,609	0	0
		12,775	0	14

North Malabar—Gallnuts are exported in considerable quantities from Rampur and Maranhalla Blocks and sold at Gundulpett—probably 10 tons annually

South Malabar.—Gallnut, Myrobalan, is not exported from this Division.

TERMINALIA Chebula. Brief Statement of the

MADRAS.

Nilgiris.—Is reported to be exported chiefly to Coimbatore and the Mysore Territory, the average quantity exported in each year being about 1,000 maunds.

Note—1 maund = R960 weight.

North Coimbatore.—In all, the Minor Forest Produce Contractor collected 712 *pothies* (of 192 Madras measures each) in the past two years in the hill forests, and they were sold locally and exported to Madras and Bombay.

Note—1 Madras measure = R120 weight.

South Coimbatore.—About 1,600 maunds of gallnuts are collected every year, of which about ¼ is exported to Madras, ½ to Salem District, and the rest consumed in the district.

Madura.—The average annual yield will be about 16,500 maunds, Kodaikanal and Tandigudi Ranges contributing the largest number and Kanavoypatti the least. It is not exported beyond Dindigul, where it finds a ready sale, fetching about R1 per maund. It is used in several tanneries for tanning leather.

Tinnevelly.—Approximately 42,310lb of ordinary gallnut is annually ... of the taluks in the district ... ght from them by ... The quantity of ... very small. The ... to be for the purpose of tanning leather.

... of 1897

In letter No 3135—499 En. 2, dated 1st April 1896, the Conservator of Forests in MYSORE stated that specimens had been ordered. He also reported having received certain supplies from the French Rocks Sub-Division, and inquired if these were to be forwarded under the circumstances mentioned in the copies of two letters which he enclosed. These were—letter No 804, dated 21st February 1896, from Sub-Divisional Forest Officer, French Rocks, forwarding about 60 Mysore seers of myrobalans in three bags, as under:—

Register No. 7628, ,, 7628a, ,, 7628b.

No. 1. Unripe fruit

,, 2. Fully ripe.

,, 3. Over-ripe and fallen fruits

All being the produce of about 20 selected trees in the maidan forest of Naraindrug. The instructions issued were misunderstood by the Forester who mixed together the fruit of all the selected trees, but fortunately kept separately the fruits collected during the three separate stages of growth. The Sub-Divisional Forest Officer promised a more carefully selected collection during the next season. The same officer wrote under date 24th February (No. 815) to the District Forest Officer, Mysore, that on repacking the myrobalans, it was ... being ... in an ... stated

T. 325.

MADRAS

that 'as the sample was collected when in a little riper condition, it had not the shrivelled up appearance' The letter concludes by stating that the Brahmins of Melukota make a pickle of the very tender myrobalans * The Conservator of Forests Mysore, by No 1150—61, dated 24th April 1896, was asked to send the specimens referred to By his letter No 697, dated the 3rd May 1896, the Deputy Conservator of Forests, SHIMOGA DISTRICT, Mysore, forwarded 4 bags of Myrobalans, and stated that, according to the instructions contained in this office Circular Note No. 46 of 1895-96, the collections from 1 selected tree and 20 other trees were made at three different times, and kept distinct from one another One bag contains 3 specimens of 1 selected tree packed separately and labelled as shown below —

Samples Received

No 1 Unripe fruits of one tree.
„ 2 Fully ripe ditto
„ 3 Over ripe fruits fallen to the ground

Register No 7493
„ 7494
„ 7495

Three other bags contain three sets of fruits of 20 trees as noted below —

No 4 Unripe fruits of 20 trees
„ 5 Fully ripe ditto
„ 6. *Over ripe fruits of 20 trees fallen to the ground*

No 7493 *a*
„ 7494 *a*
„ 7495 *a*

Mysore—The District Forest Officer, HASSAN, in Mysore, [illegible] ollowing [illegible] tructions [illegible] 3, over- [illegible] nade as follows —Twenty trees were selected, and a third part of the fruit from each c[illegible] kept apart [illegible] ⅔ of the frui[illegible] when these were fully ripe from each of the 20 trees and kept separate from the first batch collected The remaining third of the fruits from the 20 trees in question was picked up when they were over ripe and fallen to the ground This last batch was also preserved separate from each of the first two

Register No 7668
„ 7669
„ 7668

Hyderabad, Deccan—The Conservator of Forests, His Highness the Nizam's Dominions, by his letter No 139, dated the 3rd June 1896, forwarded two samples of Terminalia Chebula fruit as follows —No 1, over ripe fruit picked up from below the trees No 2, ripe fruit gathered from the same trees The trees in question were about 20 inches in girth and probably 12 years old The fruit was collected on 22nd April 1896 at Redepally in the Madhapur Taluk on the banks of the Godavery The fruit on the [illegible]

Register No 7713
„ 7713

BENGAL.

* This fact is alluded to by JOHN HUYGHEN VAN LINSCHOTEN in his Travells published in 1596 —*I I*

TERMINALIA Chebula. | Brief Statement of the

BURMA.

Burma.—The Officiating Conservator of Forests, Pegu Circle, Rangoon, replied (letter No 2698—54-1, dated Camp, the 28th March 1896, and again by a further letter No. 2649—41-28 under same date). These were replied to by the Reporter's letters Nos. 1152—61, dated 24th April, and 1176, of the ... Conservator wrote that ...

... that the Reporter ... note regarding the preparation of these for the Indian or home markets, and added that the information may probably be of use in assisting the rural population to tide over the years of scarcity that sometimes occur in Upper Burma from drought and in Lower Burma from inundations. Attention was drawn to the fact that the climate of Lower Burma is very damp, from May till October, and that of the Central zone of Upper Burma just the reverse. It was added that efforts were made in 1891 by the Bombay Burma Trading Corporation, Limited, to inaugurate a trade in Myrobalans, but it is understood that the proper seasoning of the fruit was the main difficulty.

The Reporter replied that the Conservator's ... early considera...

... Officiating Conservator of Forests, Tenasserim Circle, Rangoon, replied (letter No. 2090, dated 19th March 1896) that unless the matter was considered of great importance he would suggest that the experiments referred to be ... inces ...

... he could conveniently ... ...ESTERN CIRCLE, Upper ... letter No. 14—5 G.8 dated ... variety of ...

Mangosteen husk.

... connection with the present inquiry mention may be here made of an interesting letter No. 2653—41-28, dated 20th March 1896, received from the Conservator of Forests, PEGU CIRCLE, on the subject

BURMA.

Mangosteen husk.

of the husk of the Mangosteen fruit. He there calls attention to the

out this difficulty should
ight well be made from
The Conservator regrets
the Pegu Forest Circle,
er than to call attention
aterial which is at present
entirely wasted.

Reply was made by Reporter on Economic Products, No. 1151—61, dated 24th April 1896, in which he thanked the Conservator for his interesting
the Conser
to allow o
Imperial Institute for that purpose and a copy of the report when received furnished to the Conservator. The Conservator of Forests, EASTERN CIRCLE, wrote (letter No 281—36 A 6, dated 7th May 1896), that there is nothing on record to show that **Terminalia Chebula** has ever been found in that Circle.

CASSIA auriculata	Brief Statement of the

CASSIA AURICULATA.

BOMBAY.

Bombay.—The Deputy Conservator of Forests, NORTHERN CIRCLE, replied (letter dated the 17th December 1895, No 3127) that the *Tarwad* (Cassia auriculata) is not found in the Forests of that Circle

The Conservator of Forests, CENTRAL CIRCLE (letter No 5910, dated the 17th December 1895), stated that he would undertake the collection required.

The Conservator of Forests, SOUTHERN CIRCLE, replied (letter No 6154, dated the 7th January 1896) that Acacia arabica [and from the context it is presumed Cassia auriculata also] is not a tree

Circle could very possibly supply samples of Cassia

The Divisional Forest Officer, EAST KHANDESH forwarded with letter No 3—620, dated the 5th February 1896, a parcel of pounded bark of Cassia auriculata (*Tarwad*) which the '*Chambhars*' in this country use for tanning leather

CENTRAL PROVINCES

Central Provinces.—The Conservator of Forests, SOUTHERN CIRCLE, replied (letter No M.-527, dated the $\frac{18th}{23rd}$ December 1895) that Cassia auriculata is not found as a forest plant in this Circle

N.-W.-P. & OUDH

North-West Provinces and Oudh.—The Conservator of Forests, SCHOOL CIRCLE (letter No 1314, dated the 16th March 1896) stated that Cassia auriculata does not occur in the Forests of this Circle.

The Conservator of Forests, OUDH CIRCLE, reported (letter No C.-1084, dated the 19th March 1896) that Cassia auriculata is not met with in that Circle

The Conservator of Forests, CENTRAL CIRCLE, replied (letter

MADRAS

The circular was replied to by the Conservator of Forests, NORTHERN CIRCLE, letter No 1226 R C, dated 30th January 1896, who stated that steps were being taken to make the collections The Conservator added that in his opinion the difference in value probably arises

from the fact that there is a greater proportion of tannin in protected MADRAS.

immature shrubs yielded poorer bark. He concluded by stating that the relative case of stripping the bark from larger shrubs may of course have had something to do with the higher rates offered In reply the Conservator was informed (letter No. 387—61, dated 25th February 1896) that his observation as to the superiority of the bark from protected bushes is on the lines of the present inquiry. It is desired to know whether old or young bushes yield most tannin Protected bushes would very possibly be older than those not pro

matured shrubs 6-7 years old, the age being testified to by the annual Register No 7025

7027.

7029.

7031.

No. V is a sample of immature or unripe bark Sections of wood show only one ring, 7033.
growth; in fact the a
to form The age
which yielded the sample have been ascertained to be the coppice shoots of shrubs cut in the demarcation line round Chennarayabetta Forest in November 1894 Two billets of wood are sent with each sample to give an idea of the thickness of the stems from which the bark has been extracted A sample of soil where the above bark was collected is also despatched in a separate cover. 7025a 7027a. 7029a. 7031a. 7033a 7035

IMPERIAL INSTITUTE —The despatch of a supply of Cassia

commenced

The Conservator of Forests in MYSORE forwarded along with his letter No. 3616-588, dated the 28th April 1896 a parcel containing four

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions Contributions or corrections and additions will therefore be most welcome

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series Those of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series

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This sheet and the title page may be removed when the subject matter is filed in its proper place, according to the letter and number shown at the bottom of each page

THE

AGRICULTURAL LEDGER.

1896—No. 10.

OXEN AND BUFFALOES.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. V., O. 551-91.*]

VERNACULAR NAMES USED IN THE DISTRICTS OF BURMA FOR THE DISEASES OF CATTLE.

Notes by VETERINARY-CAPTAIN G. H. EVANS, A.V.D., *Superintendent, Civil Veterinary Department, Burma.*

Other PAPERS that may be consulted :

Agricultural Ledger, 1893, Nos. 16 (Diseases of the Horse) and 19 (Anthrax); 1894, Nos. 8 (Rinderpest*), 9 (Anthrax*), 10 (Charbon*), 11 (Horse Surra*), 12 (Chinese Mules), 13 (Cattle Disease*), and 14 (Cattle of Assam); 1895, Nos. 7 (Ongole and Nellore Cattle) [illegible] Cattle Plague*).

* Special Veterinary Series only



CALCUTTA:
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, I[illegible]
1896.

The objects of THE AGRICULTURAL LEDGER are —

(1) To provide information connected with agriculture or with economic products in a form which will admit of its ready transfer to ledgers,

(2) To secure the maintenance of uniform ledgers (on the plan of the Dictionary) in all offices concerned in agricultural subjects throughout India, so that references to ledger entries made in any report or publication may be readily utilised in all offices where ledgers are kept,

(3) To admit of the circulation, in convenient form, of information on any subject connected with agriculture or economic products to officials or other persons interested therein,

(4) To secure a connection between all papers of interest published on subjects relating to economic products and the official Dictionary of Economic Products. With this object the information published in these ledgers will uniformly be given under the name and number of the Dictionary article which they more especially amplify When the subject dealt with has not been taken up in the Dictionary, the position it very possibly would occupy in future issues of that work will be assigned to it

(Veterinary Series, No. 19.)
Medicinal Products.

THE

AGRICULTURAL LEDGER.

1896—No. 10.

OXEN AND BUFFALOES.

(CATTLE OF BURMA.)

[*Dictionary of Economic Products, Vol V, O 551 94.*]

Vernacular names used in the Districts of Burma for the Diseases of Cattle, by VETERINARY CAPTAIN G. H. EVANS, A.V.D., *Superintendent, Civil Veterinary Department, Burma.*

The present paper practically assumes the form of an appendix to Veterinary-Captain G H Evans' former paper on THE CATTLE AND BUFFALOES OF BURMA which appeared in *The Agricultural Ledger* No 10 of 1895.

It would serve a useful purpose were similar list of the vernacular names of the diseases of cattle to be prepared for the other provinces of India.—ED.

O. 551-94.

Diseases of Cattle (*G H Evans*) AND BUFFALOES

MON DISEASES

Charbon Symptomatique	Glanders and Farcy	Pleuro-pneumonia	Rinderpest	Tetanus
than	Zaung-gaw	Asôk yaw ga	Kyauk-pauk	May kine
Gyeik	Do	Do	Do	Do
Do	Do	Do	Do	Do
Daung dan	Do	Do	Do	Do
Hauk-na	Do	Do	Do	Do
Daung-thau	Do	Oo ba v ye shan	Do	Do
Do	Do	Do	Kut-na, Kaba-na or Mo gya na	Do
Yaung na, na Haik-na,	Zaung gaw or Zaung gaw kyaw-shouk	Thai gyi oo yaung	Kyauk pauk	Do
na, Maing na,	Do	Oo-baw-ye-shan	Kabana	Do
	Do	Do	Do	Ah-poo chôke
	Zaung gaw kyaw-shouk or Zaung-gaw oo shouk	Do	Do	Do
	Do	Lay-bet na	Do	Do
	Do	None	Kala na or Wun-kya na	Do

OXEN Burmese names for

District	UNCOM		
	Rabies	Surra	Charbon
(Burmese) . .	Kwe yu na	Thût .	Daung-
Pakokku .	Do	Do . .	Daungdan .
Minbu . .	Do .	Do . .	Daung-byat .
Magwe .	Do.	Do .	Do .
Thayetmyo	Do .	Do .	Moat so-le-byit
Prome .	Do .	Do .	Hminthet
Mandalay .	Do	Do . .	Hauk na, Gyeik
Toungoo . .	Do	Thot pye or Thot-kyauk-pyin	Daung than, Gyeik na Hauk- or Le do na
Tharrawaddy .	Do .	Do .	Hminthet, Yaing-Hauk na.
Henzada . .	Do	Thot kyan sit or Thot-pye or Thot kyauk pyin	Le lain na .
Meiktila .	Do	Thot kyauk pyin	Hauk-na . .
Yamethin .	Do .	Do .	Le do-na . .
Akyab . .	Do .	None . .	Aung na or yin na

Diseases of Cattle (G H Evans) AND BUFFALOES

MON DISEASES

Charbon Symptomatique	Glanders and Farcy	Pleuro-pneumonia	Rinderpest	Tetanus.
than	Zaung-gaw	Asôk yaw-ga	Kyauk-pauk	May kine
Gyeik .	Do	Do	Do	Do
Do . .	Do	Do	Do	Do
Daung dan	Do	Do	Do	Do
Hauk-na	Do	Do	Do	Do
Daung-thau	Do	Oo baw ye shan	Do	Do
Do	Do	Do	Kut na, Kaba-na or Mo gya na	Do
Yaung-na; na, Haik-na,	Zaung gaw or Zaung-gaw-kyaw-shouk	Thai gyi-oo-yaung	Kyauk pauk	Do
na, Maing-na;	Do	Oo-baw-yê-shan	Kabana	Do
	Do	Do	Do	A h - p o o - chôke.
.	Zaung gaw kyaw-shouk or Zaung-gaw oo shouk	Do	Do	Do
	Do	Tay-bet na	Do	Do
.	Do	None	Kala-na or Wa-kya-na	Do

OXEN — Burmese names for

District.	ORDINARY
	Foot and Mouth Disease.
(Burmese) .	*Sha-na-kwa-na* . . . . . .
Pakokhu .	Do . . . . . .
Minbu .	Do . . . .
Magwé .	Do . . . .
Thayetmyo	Do . . . .
Prome .	Do. . . . .
Mandalay . .	Do. . . . .
Tounghoo . .	Do. . . . .
Tharrawaddy	Do . . . .
Henzada . .	Do. . . . .
Meiktila . .	Sut-sut-na . . .
Yaméthin . .	Do. . . . .
Akyab . .	Do. . . . .

Diseases of Cattle (*G H. Evans*) AND BUFFALOES

DISEASES:—(A) CONTAGIOUS

Cow pox	Scabies	Influenza
Nwa kyauk	Wè	Tôh Kway
Do	Do .	Do
Do	Do .	Do
Do	Do	Do
Do.	Do	Do
Do .	Do .	Do
Do	Do	Do
Do	Do	Do
Do	Do .	Do
Do . .	Do .	Do
Do. .	Do	Do
Do. .	Do . .	Do
Do . .	Do. . .	Do

OXEN — Burmese names for

ORDINARY DISEASES.—

(a) AFFECTING

District	(b) AFFECTING ALIMEN-		
	Aptha	Inflammation of Oesophagus	Choking
(Burmese)	*Pa zat na*	*Le gyaung-yaung-gyin*	*Asa-nin-gyin*
Pakokhu	Do	Lai-do-na	Do
Minbu	Do	Do	Do
Magwé	None	Do	Do
Thayetmyo	None	Do	Do
Prome	None	Do	Do
Mandalay	Sha na-gale	Sôn-so na	Do
Tounghoo	Sha poh-na	Apoo gyeik or Sôu Sona	Do
Tharrawaddy	Do	Do	Do.
Henzada	Do.	Do	Do.
Meiktila	Do	Do.	Do
Yamethin	Do.	Do.	Do.
Akyab	Do	Lai-yan-na	Do.

Diseases of Cattle (G H Evans) AND BUFFALOES.

(B) NON-CONTAGIOUS

BONES—*Nil*

TARY SYSTEM

Vomition	Colic	Gastritis	Hoven	Impaction of Rumen	Inflammation of 4th Stomach.
Au an gyin	Wun kike-gyin	Wun yaung gyin	Wun byi wun yaung	Asa-aing kyat-gyin	Sa-dote-ta asa Aing-yaung gyin
Do	Do	None	Wau yaung	Soung-dat chouk-gyin	None
Do	Do	None	Do	None	None
Do	Do	None	Oo baw yè shan	None	None
Do	Do	None	Wun-baw-wun-yaung	None	None
Do	Do	None	Do	None	None.
Do	Do	None	Do	None	None
Do	Do	Bein byè ko-yaung or Asein-yaung	Do	Asa ma kyat or Yin bye-yin-kat	None
Do	Do	Thayet ywet-gyi gyin	Do	Do	None.
Do	Do	Oo poo laung gyin	Do	Do	None
Do	Apoo-	Do	Do.	Do	None
Do	Wè aye	Do	Do	Do	None
Do	Do	Do	Do	Do	None

OXEN — Burmese names for

District	(b) Affecting Alimentary		
	Constipation.	Diarrhœa	Dysentery.
(Burmese)	Wun-choke-gyin	Wun-hya-gyin	Thway-thoon-wun-kya.
Pakokku	Do	Do	Do
Minbu	Do	Do	Do
Magwe	Do	Do	Do
Thayetmyo	Do	Do	Do
Prome	Do	Do	Do
Mandalay	Do	Do	Do
Tounghoo	Do	Do	Do
Tharrawaddy	Apoo chôk	Do	Do.
Henzada	Do	Do	Do
Meiktila	Do	Do	Do
Yaméthin	Do	Do	Do
Akyab	Do	Do	Do

Diseases of Cattle (G H Evans) AND BUFFALOES

SYSTEM—*continued*

Enteritis	Ascites	Calculi	Hernia	Indigestion
Oo-yaung gyin	Ye byin na	Kyauk te-gyin	Moat ta	Asa ma kyay gyin
None	Do	Do.	Do	Do
None	None	Do	Do	Do
None	None	None	Do	Do
None	None	Kyauk te gyin	Do	Do
None	Ye byin na	Do	Do	Do
None	Do	Do	Do	Do
Oo yaung gyin	Byin s è	Do	Do	Do
Do.	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do.	Do.	Do
None	None	None	Do	Do
None	None	None	Do	Do.

OXEN

Burmese names for

District	(c) AFFECTING LIVER		(d) AFFECTING SPLEEN	
	Congestion of Liver	Jaundice	Enlargement of Spleen	Morbid Growths
(Burmese)	Athè n ke thway soo-gyin	Thè gyay na	Tha yet ywet ky gyin	Akya k akai
Pakokhu	None	None	Do	Do
Minbu	None	None	Do	Do
Magwe	None	None	Do	Do
Thayetmyo	None.	None	Do	Do
Prome	None.	None	Do	Do
Mandalay	None.	None	Do	Do
Tounghoo	Athè vaung na	Thè gyay na	Do	Do
Tharrawaddy	Do	Do	Do	Do
Henzada	Do	Do	Tl ayet ywet yaung	Do
Meiktila	None.	None	None	Do.
Yaméthin	None	None	Thayet ywet yaung	Kyat poo
Akyab	None.	None	None	None

Diseases of Cattle (*G. H Evans*) AND BUFFALOES.

(c) Affecting Respiratory System						
Cough	Catarrh	Laryngitis	Bronchitis	Congestion of Lungs	Asthma	Pleurisy
Chaung soe-na	Nha-see-na	Le-myo-poo laung-na	Chaung-soe-na	Asôk poo laung-na	Pan na	Lay ta-gyin-na
Do	Do .	Gyeik hauk	None	None	Thet lou kwè	Do
Do	Do	Do.	None	None	Do	None
Do	Do	Do	None	None	Do	None
Do	Do	Do	None	None	Do	None
Do	Do	Do	None	None .	Do	None.
Do	Do	Do	None	None	Do	None
Do. .	Do	Apoo môke	Tan na	Asôk poo-laung-na	Do	Lay ta-gyin-na
Oo-au-na	Do	Do	Do	Asôte-na	Do	Lay tah-na.
Do .	Do	Do	Do	Do. .	Leight na	Lay-an-na
Do	Do .	Do.	Choung-sae.	None .	Do .	None
Do	Do .	Atwin-kyat.	Do. .	Lay-bet-na.	None .	None
Do .	Do .	Le-myo-poo-gyin.	Do. .	None .	Leight-na	None.

OXEN — Burmese names for

District	(*f*) Affecting Heart and — (*g*) Affecting Nervous System: Paralysis	Epilepsy	Apoplexy
(Burmese)	Lay-gyaw-the-na	Tet-na	Wet-yoo-na
Pakokhu	Do	Do	Do
Minbu	Do	Do	Do.
Magwe	Do.	Do	Do
Thayetmyo	Do.	Do	Do
Prome	Do	Do.	None
Mandalay	Lay-byat-na	Do	Wet-yoo-na
Tounghoo	Lay-pyat-na	Do	Wet-yoo-na *or* Wut-na
Tharrawaddy	Do	Do.	Do
Henzada	Chenai	Do.	Do.
Meiktila	Do	Do	Do
Yaméthin	Kalai-na	None	None
Akyab	Do	Tet-na	Wet-yoo-na *or* Wut-na.

Diseases of Cattle. (*G H Evans*) AND BUFFALOES.

CIRCULATORY SYSTEM :—*Nil.*

	(*h*) AFFECTING EYE		
Chorea.	Conjunctivitis Opthalmia	Worm in Eye	Opacity of Cornea
Akyaw-swè-na .	Myet-se-na	Myet-pôh-na	Tain-tha-la.
Do .	Do .	Myet-poh-da-na	Do
Do.	Do	Do	Do
Do.	Lait pya-soat	Do	Do.
Do.	Do .	Do	Do
Do. .	Do. .	Do	Do.
Do.	Do .	Do	Do
Do	Do .	Do	Do
Tone-na *or* Sun-na	Do.	None .	Do.
Tone-na .	Do. . .	Myet-poh-swè	Do
None . .	Do. . .	Do .	Do
None . .	Do. . .	Do .	Do
Tone-na *or* Sun-na.	Do .	Do	Do

OXEN — Burmese names for

District.	(i) Affecting Skin.	
	Warts.	Maggots.
(Burmese)	Kywet-nō	Lauk
Pakokhu	Do.	Poh-kya
Minbu	Do.	Do.
Magwé	Do.	Do.
Thayetmyo	Do.	Do.
Prome	Do.	Do.
Mandalay	Do.	Do.
Tounghoo	Do. *or* Noo-na	Do.
Tharrawaddy	Ka-toot-na, *or* Ma-da-ma-na.	Do.
Henzada	Do.	Do.
Meiktila	Do.	Do.
Yaméthin	Do.	Do.
Akyab	Do.	Do

Diseases of Cattle. (*G. H. Evans*) AND BUFFALOES

		(*j*) Parasitical.	
Ringworm.	Tumours.	Intestinal worms.	Pediculi.
Pway .	Akyeik-akai .	Than-toh-na .	Thun.
Do. . .	Do. .	Do. .	Do.
Do . .	Do. .	Do. .	Do.
Do. . .	Do. .	Do. .	Do.
Do .	Do .	Do. .	Do.
Do . .	Do. .	Do. .	Do
Do. . .	Do. .	Do. .	Do.
Do. . .	Do. .	Do. .	Do.
Do. .	Do. .	Do. .	Do.
Do. . .	Do. .	Do. .	Do.
Do. .	Do. .	Do. .	Do.
Do. . .	Kyat poo . .	Do. .	Do.
Do. . .	Do. .	Do. .	Do.

OXEN — Burmese names for

District	(1) Affecting Skin	
	Warts	Maggots
(Burmese)	Kywet no	I auk
Pakokhu	Do	Poh kya
Minbu	Do	Do
Magwe	Do	Do
Thayetmyo	Do	Do
Prome	Do	Do
Mandalay	Do	Do
Tounghoo	Do *or* Noo na	Do.
Tharrawaddy	Ka toot na *or* Ma-da ma na	Do
Henzada	Do	Do
Meiktila	Do	Do
Yaméthin	Do	Do
Akyab	Do.	Do

Diseases of Cattle (*G H Evans*) AND BUFFALOES

		(*j*) PARASITICAL	
Ringworm.	Tumours	Intestinal worms	Pediculi
Pway .	*Akyeik akai*	*Than toh na*	*Thun*
Do .	Do	Do.	Do
Do .	Do	Do	Do
Do .	Do	Do	Do
Do .	Do	Do	Do
Do	Do	Do	Do
Do .	Do	Do .	Do
Do .	Do	Do	Do
Do .	Do	Do	Do
Do .	Do	Do	Do
Do .	Do	Do	Do
Do .	Kyat poo .	Do	Do
Do .	Do	Do .	Do

OXEN Burmese names for

District.	(k) AFFECTING GENERATIVE		
	Metritis	Parturient Fever	Parturition
(Burmese) . .	Tha-aing-yaung-na	Me-yat . .	Mway pwa-gyin
Pakokhu . .	Do .	Do. . .	Do. .
Minbu . .	Do	Do . .	Do
Magwe .	Do.	Do . .	Do.
Thayetmyo .	Do. .	Do. . .	Do. .
Prome . .	Do	Do . .	Do. .
Mandalay . .	Do. .	Do. . .	Do .
Tounghoo . .	Do. .	Me-yat-pein .	Do. .
Tharrawaddy .	Do .	Do. .	Do. .
Henzada . .	Do. .	Do. .	Do .
Meiktila . .	Do. .	Do. .	Do. .
Yaméthin . .	None . .	None . .	Do. .
Akyab . .	None . .	Me-yat-pein .	Do. .

Diseases of Cattle (*G H Evans*) AND BUFFALOES

Organs			(*l*) Fevers	
Mammitis	Abortion	Orchitis	Rheumatic fever	Malarial fever
Noh ohn yaung na	Ko-wun byet na	Gway yaung-na	Doo la	Nget pya
Do	Tha-shaw gyin	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Tha pyet *or* Tha shaw	Do	Padayat na	Do
Do	Tha shaw	Do	Doo-la	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Lay bet na	Do
Do	Do	Do	Do	Do

OXEN

Burmese names for

District	(m) Affecting Urinary System		
	Nephritis	Urethritis.	Rupture of Bladder.
(Burmese) .	Kyaukkat-yaung gyin	Nyaung-na	Tha-aing pauk-gyin.
Pakokhu . .	None .	Do	None .
Minbu . .	None	Do.	None .
Magwe . .	None .	Do	None .
Thayetmyo .	None .	Do	None .
Prome .	None .	Do	None .
Mandalay . .	None .	Do	None . .
Tounghoo .	Kha kike na	Ye-byin na *or* ye ne-na.	Tha aing pauk-gyin
Tharrawaddy .	Do	Do .	Do .
Henzada . .	Do	Do	Do .
Meiktila . .	None .	Do	Do .
Yaméthin . .	None .	None .	None . .
Akyab . .	None .	Ye byin na *or* ye-ne na	None . .

Diseases of Cattle (G H Evans) AND BUFFALOES

(n) Affecting Locomotory System

Incontinence of urine	Dislocation	Laminitis	Abscess
See aung gyin	As te lwai gyin	Tok kine myay-swè	Ana byat
Do	Do	Do	Do
Do	Do	Do	Do
Do	Do	Do	Do
Do	Do	Mye k e	Do
Do	Do	Do	Do
Do	Do	Do	Do
Do	Do	Do	Ye thà
Do	Do	Do	Do
Do	Do	Do	Do
Do	Do	Do	Kyat na
Do	Do	None	Do
Do	Do	Mye kine	Do

OXEN Burmese names for

District	(o) Miscellaneous		
	Rheumatism	Anæmia	Scrofula
(Burmese)	Doo la	Che nai gyin	Kvat
Pakokhu	Do	Do	Do
Minbu	Do	Do	Do
Magwe	Do	Do	Do
Thayetmyo	Do	Do	Do
Prome	Do	Do	Do
Mandalay	Do	Do.	Do
Tounghoo	Do	Do	Do
Tharrawaddy	Do.	Do	Do
Henzada	Do	Do.	Do
Meiktila	Le bat na	Do	Do
Yaméthin	Do	Do	Do.
Akyab	Do	Do	Do

Diseases of Cattle (*G H Evans*) AND BUFFALOES

SURGICAL OPERATION	WOUNDS			
Castration	Punctured	Incised	Contused	Lacerated
Gway thin gyin	Soo nyaung doh na	Dah klot na	Atha kyay na	Tha ye soak pyat na
Sôn wa thin koot	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Thin koot *or* Son ma	Do	Do	Do	Do
Do	Do	Do	Do	Do
Son ma *or* Bhe theni	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do
Do	Do	Do	Do	Do

G I C P O—No 66 R & A —21-9-96 —1 00 —W B G O 551-94.



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ble Product Series, No. 23.)
(Fibres).

THE AGRICULTURAL LEDGER.

1896—No. 11.

CROTALARIA JUNCEA.

(SUNN-HEMP)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol II, C 2105.*]

SUNN HEMP FIBRE

Result of Examination in the Research Department Imperial Institute, London.

Other DICTIONARY articles that may be consulted:

Corchorus, *Vol II*, C 1879,
Hibiscus cannabinus, *Vol IV* H. 177,
Urena lobata, *Vol VI, Part IV* U. 29,
also
The Agricultural Ledger, 1894, No 18, 1896, No 6.



CALCUTTA
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA
1896.

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v

(Vegetable Product Series, No. 23.)
(Fibres.)

THE

AGRICULTURAL LEDGER.

1896—No. 11.

CROTALARIA JUNCEA.

(SUNN-HEMP)

[*Dictionary of Economic Products, Vol II*, C. 2105.]

SUNN-HEMP FIBRE.

Result of Examination in the Research Department, Imperial Institute, London.

Examination of Sunn-Hemp fibre

On the 8th January 1896 2lb of the best quality of Sunn-Hemp fibre (Crotalaria juncea) produced in the Tavoy district, Burma, and received from the Revenue Sec
No 705—8 A -8, dated
London, for examinatio
No. 22/73 Flying Seal, dat
to be furnished on the
together with any rem
the fibre might be improved. These requests were made at the instance of the Burma Administration.

The Secretary and Director, Imperial Institute, acknowledged receipt of the sample on the 13th February 1896 (Flying Seal Series No 74), and stated that portions of it had been examined by practical experts of

Sir Frederick Abel further stated the fibre was being examined in detail by the comparative process adopted in the Research Department of the Institute, and that the results would follow

CROTALARIA juncea.

Sunn-Hemp

These were duly received with Flying Seal letter No 77, dated the 20th February 1896, together with results of the examination of a sample of Sunn-Hemp grown in Calcutta taken from the collection of fibres in the Indian Section of the Institute

Results compared

	Moisture.	Ash	Loss by Hydrolysis. (a)	Loss by Hydrolysis. (b)	Loss by Mercerising.	Loss by Acid purification.	Gain by Nitration	Cellulose.	Length of ultimate fibre
	Per cent	Per cent	Per cent	Per cent	Per cent.	Per cent	Per cent	Per cent	m m
LEGUMINOSÆ									
Crotalaria juncea (Burma)	9 8	3 1	9 2	15 8	8 8	3 7	35	87 4 87 5	5- -8
Crotalaria juncea (Calcutta)	9 4	5	10'5	14	9 1	1 6	?	90 6 91 0	5- 55

[illegible]

Results of examination of two other fibres.

	Moisture.	Ash.	Loss by Hydrolysis (a)	Loss by Hydrolysis. (b)	Loss by Mercerising	Loss by Acid purification.	Gain by Nitration.	Cellulose	Length of ultimate fibre
	Per cent	Per cent.	Per cent	Per cent.	Per cent	Per cent.	Per cent.	Per cent	m m
MALVACEÆ									
Hibiscus cannabinus (Saharanpur)	10'8	1'	12 2	19'1	18 3	2 7	40'	74'9	3- -4
Urena lobata (Manbhoom)	9 9	2 4	12'2	16 3	15'7	3 0	25 8	73 5	2 2- 5

Fibre. CROTALARIA juncea.

Sir Frederick Abel concludes by remarking that "the Hibiscus cannabinus, which has I believe, been proposed as a substitute for jute in some districts of India where the latter is not cultivated is shown to be superior to jute of average quality. The measurements of length of fibre have been carefully made, and they agree with those obtained by Messrs. Cross and Bevan in the examination of a sample of fibre from the Colonial and Indian Exhibition. Hibiscus cannabinus.

The Urena lobata is also a fibre of the jute type, possessing very similar qualities to jute. The staple of the fibre is short, and the percentage of cellulose which it was found to contain is somewhat lower than that observed by Messrs. Cross and Bevan in their published analysis of a sample of the same description of fibre." Urena lobata.

G. I. C. P. O.—No. 94 R & A.—25-7-96.—2,100.—W. B. G.

C. 2105.

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(Veterinary Series, No. 21.)

THE

AGRICULTURAL LEDGER.

1896—No. 13.

OXEN.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. V, O. 551–94.*]

Review of Correspondence on the subject of Contributions to the Veterinary Series of 'The Agricultural Ledger'

Other PAPERS that may be consulted:
The Agricultural Ledger 1895, No. 6



CALCUTTA:
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA.
1896.

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E. C. BUCK,
Secretary to the Government of India.

(Veterinary Series, No. 21.)

THE

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1896—No. 13.

OXEN

[*Dictionary of Economic Products, Vol. V*, O. 551–94]

Review of Correspondence on the subject of Contributions to the Veterinary Series of 'The Agricultural Ledger'

Towards the end of last year (1895), the Editor received a letter on the subject treated of in the Agricultural Ledger No 6 of 1895, ... In that letter it was ... d publishing in the Ledger of notes ... issued would be attended by useful results ... dicated the various points on which it might be deemed desirable to collect information

The Editor gladly availed himself of this voluntary offer to assist in providing information and in referring the matter to the Civil ...

... be the outcome of practical experience ... that most of the subjects on which it is proposed to contribute notes have been dealt with fairly exhaustively by professional workers and others in various parts of the world yet doubtless notes on the different subjects indicated written in a simple manner would be welcomed by those who have charge of dairies and cattle The writer goes on to say that in his opinion experiments in any direction connected with cattle should be made known for general information Trials of indigenous drugs are especially interesting and valuable, and the Assistant Inspector General cordially offers any assistance he can give, and concludes by suggesting that all who are interested in Cattle and Cattle Disease be invited to contribute an account of their experiences

(1) How to identify the age of the cow and number of parturitions

(5) Medicine for producing heat or oestrum in barren heifers or cows.

(6) Medicine for expulsion of after-birth if retained.

(7) Symptoms and treatment, etc., of Cattle Disease.

The Editor will also gladly examine and, where possible, identify the indigenous drugs sent to him but would remind persons desirous of contributing to this commendable work that they should follow as far as possible, the rules for the collection of specimens laid down in *The Agricultural Ledger No. 4 of 1894*.

Notes, reports or suggestions as received will be transmitted to the Civil Veterinary Department, and when of sufficient merit will be published in the Ledger. When thought desirable arrangements will be made to have the efficacy of the drugs, that may be recommended for trial by correspondents put to careful therapeutic test.

All interested in Dairy Farming or in the rearing of Cattle are cordially invited to contribute.

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THE

AGRICULTURAL LEDGER.

1896—No. 14.

PINUS EXCELSA.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. VI., Pt I., P 737.*]

PINUS GERARDIANA.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol VI, Pt I, P. 746.*]

PINUS KHASYA.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. VI, Pt I, P. 757*]

PINUS LONGIFOLIA.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. VI, Pt I, P 760.*]

PINUS MERKUSII

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. VI, Pt I, P. 771*]

INDIAN TURPENTINES.

Results of the Examination of Indian Turpentines in the Research Department of the Imperial Institute by PROFESSOR H. E ARMSTRONG F R S *Also a Review of the Correspondence relating to Collection of Specimens by the Reporter on Economic Products.*



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[*Dictionary of Economic Products, Vol VI, Pt I*, P 746]

PINUS KHASYA.

[*Dictionary of Economic Products Vol VI, Pt I*, P. 757]

PINUS LONGIFOLIA.

[*Dictionary of Economic Products, Vol VI, Pt I*, P 760.]

PINUS MERKUSII.

[*Dictionary of Economic Products, Vol I, Pt VI*, P. 771]

INDIAN TURPENTINES

Results of the Examination of Indian Turpentines in the Research Department of the Imperial Institute by PROFESSOR H E. ARMSTRONG F R S *Also a Review of the Correspondence relating to Collection of the Specimens by the Reporter on Economic Products*

In the *Imperial Institute Hand book No 7* on RESIN AND TURPENTINE FROM INDIAN PINES, mention is made (pp 21 23) of a sample of turpentine derived from either Pinus khasya or Pinus Mer- [illegible]

29th May 18[illegible]

offered to undertake the task if furnished with 3 cwts of the freshly collected crude exudation from each kind of tree With letter

P. 736-773

PINUS	Indian Turpentines

2nd June 1894 No 23 F S, dated the 2nd June 1894, Sir F Abel forwarded the Professor s letter to the Government of India, and recommended acceptance of the gratuitous offer He further stated that in the Imperial Institute sample store he had small quantities of the crude turpentine from Pinus khasya and P. longifolia, but none from P. excelsa or P. Merkusii

21st Aug 1894 After consultation with the Departments concerned a reply to Sir F Abel was sent by the Government of India (letter No 12 F S, dated the 21st August 1894) which promised to provide Professor Armstrong with 3 cwts each of the turpentines of P. excelsa, [illegible] P. longifolia and P. Merkusii, and 5lb each of [illegible] letter in

28th Sept 1894 [illegible] expressed [illegible] e four prin [illegible] pointed out the necessity to beat [illegible] knowledge as to the resources generally, of India in regard to this particular product inasmuch as it is not improbable that new and important applications for turpentine may arise,' for it is just 'conceivable that India rubber may be artificially manufactured in the future from turpentine and in that case the resources of India as regards this particu ar liquid may assume considerably increased importance

25th Jan 1895 The Inspector General of Forests on the 25th January 1895 addressed his letter No 45 to the Conservator of Forests School [illegible] which he called upon him to supply [illegible] ngifolia, [illegible] onservator [illegible] urpentines but not the oils of [illegible]

N W P and OUDH *4th Feb 1895* North West Provinces and Oudh — Reply was made to [illegible] General of Forests by the Conservator of Forests School [illegible]

20th Feb 1895 No 1117—XVI 43 dated [illegible] Indian species of Pinus besides Pinus excelsa, P. khasya, P. lon[illegible] understood to be P. Gerardiana

BURMA *11th Feb. 1895* [illegible] Eastern Circle, replied to [illegible] No 112 C R, dated 11th [illegible]

Pinus khasya. [illegible]

* Extracted from the above species by means of steam distillation

P. 736-773

ordered some experimental tapping of **Pinus khasya** to be made in the State of Thamakhan and at Bernardmyo in the Ruby Mines District The experiment at Thamakhan was carried out by Mr. Jackson, Deputy Conservator of Forests, who in January 1894 made 415 tappings on 275

BURMA. *Pinus khasya*

follows.—

January	20 days	27¾	viss.
February		43¾	„
March		84⅛	„
April		131	„
May		43	„
June		45	„
		374⅝	viss (1,365℔)

The experiment was not carried out further. The cost of collection was as follows:—

	R	a	p
Pay of coolies	212	0	0
Purchase of pots, tools, etc.	57	6	0
Cart hire to railway	27	0	0
TOTAL	296	6	0

The turpentine was made over to Messrs. Finlay, Fleming & Co, of Rangoon, who have undertaken to sell it for us in England Owing to changes of officers and other reasons, the experiment in the Ruby Mines, where the forests are of small extent and very scattered, was not carried out in a satisfactory manner Ten trees were tapped on the 21st May 1894, and more trees were tapped at intervals up to the end of August by which time 56 trees in all had been tapped and 25℔ of resin collected

Conf Appendix A.

INSPECTOR GENERAL OF FORESTS on submitting the foregoing letter stated that the Conservator of Forests, TENASSERIM CIRCLE, had been asked to supply 3 cwts of the crude exudation from **Pinus Merkusii**

BURMA —The Conservator of Forests, EASTERN CIRCLE, wrote on 3rd June 1895 (letter No. 444
3 cwts of crude turpentine fro
in the Southern Shan States
dated the 5th September 1895
16th August 1895

Pinus khasya. Registered No 6351. *3rd June 1895*

In his letter to the Inspector General of Forests, the Conservator corrected his previous statement as to **Pinus Merkusii** not being found in his Circle, in so far that the tree is met with in the Salween drainage but not within any reasonable distance of the Mandalay-Rangoon Railway.

Pinus Merkusii

PINUS.	Indian Turpentines

BURMA 17th June 1895

The Deputy Conservator of Forests, SALWEEN ATARAN DIVISION, Moulmein, advised, in his letter No 6—58, dated 17th June 1895, the despatch of about 70 viss of the resin of Pinus Merkusii

Pinus Merkusii Register No 8322 7th June 1895

SALWEEN ATARAN DIVISION —

	R	a	p
Collection of 70 viss at R35 °/o viss	24	8	0
Elephant hire for carriage of ditto	4	0	0
Bullocks	4	0	0
Cart	2	0	0
Freight by launch	0	14	0
Coolie hire	0	8	0
Purchase of 7 empty tins at annas 4	1	12	0
TOTAL	37	10	0

- No 613, Forests on from

27th June 1895

Pinus Gerardiana

ote letter cwts of t this was nt to the 500 feet sted from

10th July 1895

Pinus khasya.

unable to give any

IMPERIAL INSTITUTE 8th Aug 1895

P. 736-773

IMPERIAL INSTITUTE

turpentine from Pinus longifolia and Pinus excelsa, which had been asked for from the North West Provinces, it was believed that these would shortly arrive The letter concluded by stating that some considerable difficulty had been experienced in discovering the other trees that might be expected to afford products of the nature here dealt with Pinus Gerardiana had been mentioned, and arrangements had been made to procure 10lb of the resin from that tree.

BURMA Pinus khasya *19th Aug. 1895*

BURMA —By his letter No. 1162, dated the 19th August 1895, the Conservator of Forests, EASTERN CIRCLE, advised the despatch of specimens of the leaves and cones of the trees from which the Pinus khasya turpentine was collected Acknowledged by letter No 1252—42, dated the 20th September 1895

Pinus Merkusii. *23rd Nov. 1895.*

By letter No 1622—42, dated 23rd November 1895, the Conservator of Forests, TENASSERIM CIRCLE, was asked to supply leaves and cones of the tree from which the crude Pinus Merkusii turpentine was collected as well as information required by the Imperial Institute authorities on the following points —(1) Locality where crude turpentine was extracted, its latitude and longitude, (2) elevation, (3) number of trees tapped and number of incisions made to produce the 70 viss of turpentine, (4) months when tapped and the yield in each month, (5) average yield of each tree

IMPERIAL INSTITUTE. *25th Nov 1895.*

IMPERIAL INSTITUTE —Letter was sent on 25th November 1895

Register No 6322. No 6351

about 3 cwts of the crude turpentine of Pinus khasya. In the

the Reporter's office

PANJAB

PANJAB —By endorsement No 592, dated 8th December 1895,

P. 736-773.

Oils of the Highest Quality

chief constituent Practically they correspond exactly in properties to French oil of turpentine Professor Armstrong is disposed to think that [illegible]

purposes for which ordinary resin is used.

There appears to be no reason why India should not obtain whatever turpentine is required in the country from native sources Professor Armstrong hopes, later on, to furnish a more detailed report in regard to the composition of the oils obtained from these two turpentines.

BURMA

APPENDIX A

BURMA

Endorsemen by the Conservator of Forests, EASTERN CIRCLE, *Upper Burma,—No 200—76A 2 dated Mandaly, the 21st April 1896* — 21st April 1896.

Copy of the following forwarded to the Inspector General of Forests Calcutta for information, in continuation of this office letter No 2630—47 J, dated the 11th February 1895 —

Endorsement from the Conservator of Forests, PEGU CIRCLE, *to the Conservator of Forests,* EASTERN CIRCLE, *Upper Burma,—No 2643—41 27, dated the 21st March 1896*

[illegible] on [illegible] of [illegible] fice [illegible] ty's [illegible] her communications on th s subject being made direct and without the intervention of this office

---

Letter from MESSRS FINLAY, FLEMING & CO, *Rangoon, to the Conservator of Forests,* PEGU CIRCLE,*—dated the 20th March 1896* — 20th March 1896

[illegible] your letter, No 2544— [illegible] 30 tins of crude tur- [illegible] were under the impres [illegible] which our London firm [illegible] e for having omitted to do so

The following is from Mr Roverton Redwood, one of the highest chemical authorities of the day —

DARK COLOURED SAMPLE.

Physical Characters—Semi fluid of grey colour, and having the usual odour of crude turpentine

Results obtained on Distillation—On being distilled in a current of steam the sample yielded 29 per cent of oil of turpentine leaving a residue of dark red resin The oil of turpentine had a specific gravity of 865 at 60° F and a flashing point of 95° F (close test)

LIGHT-COLOURED SAMPLE

Physical Characters—(Fluid somewhat viscid) nearly white in colour and with the usual odour of crude turpentine

Results obtained on Distillation—On be ng distilled in a current of steam the sample yielded 25 per cent of oil of turpentine, leaving a residue [illegible] of 858 at 60° F and a [illegible] of the o l of turpentine obtained by distillation in a current of steam was found to have a bo ling

PINUS	Indian Turpentines

BURMA.

point ranging from 310° to 360° F and a specific rotatory power + 32° 36'.

General Remarks—Even the darker of the two samples yields oil of turpentine of good merchantable colour and odour, and the lighter sample gives a good resin The yield of oil of turpentine from ... s satisfactory both as regards quant ... possesses the same ch ... States having a dextro ... polarised light and having ... to answer all the ... ed, but I would sug ... a few barrels of it should be distilled, and ... of it made by converting it into varnishes

The following is from a London firm of Brokers —

"If imported to this country in the crude state, the stills would have to be erected in an isolated position so as to avoid the risk of fire To obtain the refined spirits of good colour the stills would have to be of copper One of the principal distillers of Resin here values your crude turpentine at £4 to £6 per ton, and if he could obtain a constant supply at about this price he would be willing to go to the expense of erecting plant to work it This price is based on the present value of American Refined Spirits of Turpentine at £22 per ton We may mention that during the last few years the price of this article has varied between £20 and £28 in London, and as the market has been growing of late we should consider £24 the highest figure that can be reasonably expected for some time to come The value of the resin obtained from your crude turpentine would be from £5 to £6 per ton in London"

The following is from a large firm of varnish manufacturers :—

"We have carefully tested the two samples of Indian turpentine with the following results —

	Dark quality	Light quality
Water	18 7	13 0
Spirit	21 3	24 5
Resin	60 0	62 5
	100 0	100 0

The spirit appears to be about equal to Russian Turps and Resin about F Grade. To work it would necessitate a special plant being laid down, our resin stills not being suitable. We are willing to entertain the matter if we are guaranteed a certain supply *per annum* at a price not exceeding £4-10-0 per ton on our works"

It is evident from these reports that the Turpentine is of good quality, but at the prices named we fear it would not be possible to ship it at a profit to the London market

It would certainly be out of the question to ship it in its crude form to sell at £4-10-0 per ton—a price which would do little more than cover cost of packing and freight

Taking the quotations given for the refined products, *viz* £24 per ton for Spirits of Turpentine and, say, £5-10-0 for Resin and allowing, say, 15 per cent for moisture, the return would be about £9-6-0 per ton to cover first cost cost of refining, freight to London and sale expenses

Do you think it worth while, and will you give us an idea of the probable quantity? We shall be glad to ascertain from our London friends the cost of refining plant

P. 736-773.

Indian Turpentines	PINUS.

Copy of letter No 2642—41-27, dated Camp, the 21st March 1896, from the Conservator of Forests, PEGU CIRCLE, *to* MESSRS FINLAY, FLEMING & CO, *Rangoon*

N W P and OUDH

21st March 1896

In thanking you for [illegible] reports on the crude turpe[illegible] inform you that the atte[illegible] CIRCLE, Upper Burma, h[illegible] your letter, and that he has been invited to communicate direct with you as the specimens reported on were originally supplied by him.

APPENDIX B

Forest Department Reports, North-West Provinces for year ending 30th June 1894, pages 78 and 79, paragraphs 60 to 64.

60 *Resin*—In the Jaunsár Division the tapping of pines for resin continued No new trees were operated on, but about 3,900 trees previously worked were again tapped 639 maunds of resin were collected at a cost of R1,168 The cost of collection was about R1-13-3 per maund against [illegible] previousl[illegible] time anc[illegible] weight of[illegible] the year —

		R
Collection of 639 maunds of crude resin	.	1,168
Price of boxes, tins earthen pots, etc	.	769
Carriage of 624 maunds of crude resin to Dehra	.	808
TOTAL	.	2,745

61 *Turpentine and Colophony*—431 maunds of crude resin were distilled in Dehra giving 278 maunds of rosin and 44 maunds or 400 gallons of turpentine [illegible]

P. 736-773.

PINUS. **Indian Turpentines**

N.-W. P. and OUDH

The Conservator has put together the actual results of four years' working of the resin operations in the following table:—

PARTICULARS	1890-91	1891-92	1892-93	1893-94	TOTAL.
Number of maunds of crude resin collected . .	201½	299½	623¼	639	1,763¼
Number of maunds of crude resin sold locally	22	200	3½	15	240½
Number of maunds of crude resin sent to Dehra	191	328	639	382	1,540
Number of maunds of colophony sold	118	253½	380½	278	1,030
Number of gallons of turpentine sold or used .	45	168	1,168	624	2,005
Revenue from crude resin R	46	800	15	68	929
" " colophony "	655	1,397	1,858	1,563	5,303
" " turpentine "	127	353	2,510	1,306	4,296
Value of resin and turpentine in stock . "	.	.	..	2,773	2,773
TOTAL . R	828	2,150	4,413	5,710	13,501
EXPENDITURE					
Capital . . .	305	20	20	.	345
Working—					
Cost of collection .	562	561	942	1,168	3,233
" carriage	234	428	766	808	2,236
Dehra expenses .	95	260	363	432	1,150
Chakráta .	124	218	471	819 (Chakráta and Bags, drums, etc., bracketed together)	2,866
Bags, drums, etc. .	280	365	583		
Carriage by rail . .	89	182	274	163	688
TOTAL .	1,384	2,014	3,385	3,330	10,173

The net results consequently are:—

	R	R
Revenue . .		13,501
Expenditure, working	10,173	
10 per cent, of capital	35	
		10,208
Profit .		3,293

on 1,763¼ maunds of resin collected

... In 1891-92 ... of course ... over it and ... The intro- ... isfactory to ... the Ions ... not only the ... stoms tariff taxes the imports of resin and turpentine into India, there is every reason for customers to get their supplies from the local industry. At the

Indian Turpentines.	PINUS.

N W P and OUDH

[illegible] for [illegible] illed [illegible] ling carriage to Chakráta, amounted to R41-11 0 It is being tried by one or two purchasing firms, but the result is not yet known.

63 *Chír, Tar and Pitch* —The demand for these articles has not improved, but small indents are being received and small quantities sent out for trial The effects of the new customs tariff ought to be perceptible in the case of all these products

64 Nothing further has been heard of the proposal to use fir wood for the manufacture of matches, but the question of its utilization for making tea boxes has been under discussion, and it is very probable [illegible]

backs, and similar articles, and every endeavour will be made to assist in their being procured, through the medium of the purchasers of coupes.—(*Forest Dept Report, N-W P, year ending 30th June 1894.*)

P. 736-773.

G. I. C P O.—No. 100 R. & A —28-7 56 – —.B N D.

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions Contributions or corrections and additions will therefore be most welcome

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series

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This sheet and the title-page may be removed when the subject-matter is filed in its proper place, according to the letter and number shown at the bottom of each page

THE

AGRICULTURAL LEDGER.

1896—No. 15.

(REPRINT FROM MADRAS RECORDS)

MAGNESIA.

(DICTIONARY OF ECONOMIC PRODUCTS, Vol V, M. 52)

REPORT ON THE MAGNESITE AREAS OF THE CHALK HILLS, &c, NEAR SALEM

By C. S. MIDDLEMISS, B A, *Geological Survey of India.*



Madras:
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS.

1896.

The objects of THE AGRICULTURAL LEDGER are—

(1) To provide information connected with agriculture or with economic products in a form which will admit of its ready transfer to ledgers,

(2) To secure the maintenance of uniform ledgers (on the plan of the Dictionary) in all offices concerned in agricultural subjects throughout India so that references to ledger entries made in any report or publication may be readily utilised in all offices where ledgers are kept,

(3) To admit of the circulation in convenient form of information on any subject connected with agriculture or economic products to officials or other persons interested therein,

(4) To secure a connection between all papers of interest published on subjects relating to economic products and the official Dictionary of Economic Products With this object the information published in these ledgers will uniformly be given under the name and number of the Dictionary article which they more especially amplify When the subject dealt with has not been taken up in the Dictionary, the position it very possibly would occupy in future issues of that work will be assigned to it

E C BUCK,
Secretary to the Government of India

(Mineral and Metallic Series No. 1)

THE AGRICULTURAL LEDGER.

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(REPRINT FROM MADRAS RECORDS)

MAGNESIA.

[*Dictionary of Economic Products, Vol V, M 52*]

REPORT ON THE MAGNESITE AREAS OF THE CHALK HILL &c NEAR SALEM

Note by C. S. MIDDLEMISS B.A. *Geological Survey of India*

INTRODUCTION

BOUT the middle of November last I received a communication om the Madras Government asking me to examine the above eas (G O, dated 12th November 1894) Accordingly a good art of the cold weather season of 1894-95 was spent in their udy

The main results of my examination are embodied in this eport which deals with—

(1) The two areas of the Chalk hills
(2) That of the north west end of the Kanjamallai hill
(3) That near Valaiyapatti in the Námakkal taluk

Of these three areas the first is by far the most important They will be taken for description in the above order

(1) CHALK HILLS

The two areas embraced under the above name have been described by Messrs King and Foote in their Memoir (*Mem G S of India*, vol IV, pt 2, 1864) The same areas were cursorily examined by Mr Holland quite recently, and described (*Records G S of India*, vol XXV, p 1 5 1892)

Whilst the two former observers give a fairly detailed description of the mode of occurrence of the magnesite, with remarks on the accompanying minerals, the latter was able to come to more definite and accurate conclusions regarding the

mode of origin of the magnesite, chromite, etc —conclusions which have been abundantly confirmed and illustrated by my own visit

In taking up work myself on these extremely interesting rocks, it was clear (considering that a generally descriptive account, and an up to-date theory of them existed already) that any advance that I could make on the work of my predecessors must be in the direction of greater accuracy as regards detailed surveying of the minerals and rocks of the area My line of action was therefore clear, and the first step towards it was to obtain a detailed topographical map This I found not to exist, and so, as the shortest way out of the difficulty, I set to work and plane tabled the two magnesite areas of the Chalk hills myself on the scale of 6 inches to 1 mile, showing sketched contours of 10 feet A tracing of the map, geologically coloured, accompanies this report

It will be seen, therefore, that the apparently simple request of the Madras Government for further information about the magnesite of these hills was really a call of a more serious nature than would appear at first sight—if I were to see anything and report anything beyond what was already known and published

Position and area

The Chalk hills lie a few miles north of Salem town They comprise two areas, a smaller one to the south, through which at its south-west end the Madras Railway and the road to Omalur pass, and a larger one to the north-east of the latter, and which keeps a position to the east of the railway and road The former contains about $1\frac{1}{4}$ square miles and the latter (so far as shown in my map) about $3\frac{1}{2}$ square miles It extends, however, further away in a north easterly direction

Orography

The hills rise gently from the plains, and expose a set of low undulating surfaces, generally bare of vegetation and without water They are streaked with white, owing to the veins of magnesite (carbonate of magnesia) from which (erroneously) the name Chalk hills is taken

General Geological structure

The structure of the two magnesite areas may be summarised as follows —

(1) The plains surrounding the Chalk hills are composed of an ancient gneissic series, wrapped into folds with a N E — S.W. strike

Hills near Salem (*C S Middlemiss*)	Magnesia

(2) The two areas of the *Chalk* hills are essentially two great intrusive masses of olivine chromite rock, and other olivine bearing rocks, which, from their containing little or no felspar or quartz, belong to the peridotite, or ultra-basic group of rocks, such as dunites, picrites, etc These rocks, owing to the unstable mineral olivine, have undergone enormous mineral change, whereby, first the dunite became serpentinised more or less completely, and secondly, the serpentinised product was further altered with the formation of magnesite, chalcedony, etc

The Dunite and its contained mineral Chromite

Mr Holland was the first to detect the presence of dunite in the specimens which he collected in the Chalk hills and north-west of Kanjamallai hill—see foot-note at p 144 of Mr Holland's paper

This rock, first known from the Dun mountain, New Zealand, is composed entirely of olivine and chromite, and as such, in an unaltered condition, it is found at many places in the Chalk hills where the rock has resisted the metamorphic influences tending to convert it into serpentine The top of "J" hill and of "Tent" hill, and the western end of the south area are examples of places where the rock, of a grey or greenish grey colour, may be observed The grey rock (colourless in thin section), such as is found on the summit of "J" hill and near "KK" hill, might be at first sight mistaken for a quartzite until the high specific gravity arouses suspicion

The microscope shows the rock to be composed almost entirely of a coarsely crystalline aggregate of olivine, felted together, and with minute black crystalline grains of chromite dotted through it

A chemical analysis of the "J" hill specimen No 10 189, made in the survey laboratory by Mr Blyth, gave—

Silica	39 10
Magnesia	48 26
	87 36
Iron, alumina Manganese Chromium Moisture, etc	12 64
	100 00
The specific gravity was	3 176

M 52

between "Tent" hill and "Green bush" hill, and in the one to the south west of "Tent" hill, show that the centre of this area is approximately the true location of the chromite No mines have been worked in the area, but I have no doubt that if extensive quarrying of the magnesite is ever carried out, chromite veins will in due course be laid bare

As for the quality of the ore, the nodules and lumps as picked up among the hills show that it is practically a granular-crystalline aggregate of the pure mineral, chromate of iron, the theoretical composition of which, as given by Dana, is—

Chromium sesquioxide	68 0
Iron protoxide	32 0
	100 0

but chromite varies much in the amount of the sesquioxide present, 50 per cent being considered a very good quality of ore

The actual analysis of the ore, as found in the north area of the Chalk hills, is given in Newbold's paper referred to above It was made by Mr I Solly, and gave—

Chromium sesquioxide	49 00 per cent
Which is about equivalent to chromic acid	57 00 "
Or to cent per cent of chromate of potash	

The following description of the method of working and transporting the ore to the coast is taken from Newbold's report —

' The ore is separated from the rock by means of pickaxes, chisels ' wedges, and hammers, sorted and piled up into little heaps on the ' ground in front of the huts occupied by the superintendents, where ' it remains until the Cauvery becomes navigable, that is, from the end ' of June till the end of September It is then sent down by land to " Moganoor, a place on the river about 40 miles southerly from Salem, ' whence it is boated to Porto Novo on the Coromandel coast Thence ' it is shipped to Europe by the Porto Novo Iron Company "

About 100 tons are said to have been extracted from the mines, one block of which weighed two tons, but it was found that the export of the crude ore to England did not pay owing to the quantities available from Scotland, Styria, etc At a depth of 50 or 60 feet from the surface water was met with, and it is not impossible that it was this difficulty which helped

largely to stop the work, inasmuch as no better means of removing the water were used than buckets and ropes

Other Ultra Basic and Basic rocks of the Chalk hills

Besides the dunite, and its more immediately derived serpentine and chromite veins, there occur, somewhat sparingly, examples of other less basic rocks They are generally black or of dark colour, and stand out in rounded lumps, having escaped the great alteration which the dunite has suffered They are represented on the map by a purple colour Many of these in the north area are situated round the margins of the dunite intrusion One remarkable one is found to the east of "Green bush" hill in the south area All these rocks contain olivine, but not to the exclusion of everything else They also contain green pyroxene, and sometimes black mica Some also contain a small amount of plagioclase felspar thus linking the ultra basic rocks with the basic

It is not absolutely certain how these rocks made their appearance in this area, but one reasonable hypothesis is that, lying as they do at the outer edge of the great dunite intrusion, they represent the lighter portions of the molten magna which separated at the surface, whilst the more basic elements of it tended to sink by their higher specific gravity and so occupy what is now a more central portion of the Chalk hills areas But, as the study of these rocks is of more petrological interest than of economic importance I do not propose to do more here in the way of describing them, but to confine myself to stating that, as they hint at an increasing basicity of the rocks as we travel inwards and downwards from the outer edges of the two areas, they point to the possibility of the heavier minerals, *e g*, *chromite*, being found in greater abundance at greater depths

Another set of hornblende garnet rocks which form the high ridge "HHJJ" between the north and south areas will similarly be neglected in this report

The Magnesite veins

I come now to the mineral which is most abundantly represented in the Chalk hills, that is, the magnesite, or carbonate of magnesia Its general characteristics, mode of occurrence, and appearance have been described by many observers, among whom may be mentioned Newbold (*Journal Roy Asiatic Soc* vol VII, p 161, 1842), King and Foote in their memoir cited above, and lastly Holland The descriptions of the earlier observers

Magnesia — The Magnesite Areas of the Chalk

stand good at the present day, if we simply substitute the more correct mineralogical descriptions of the rocks from which it was originally derived in the place of the hornblende schists, micaceous and massive talcose schists, basalts, etc., of these observers. The mistake made by them (perfectly intelligible before the microscope was regularly employed for the examination of rocks by means of thin sections) was of a simple nature. They looked upon the area of the Chalk hills as primarily a focus of metamorphism, brought about by a locally intense extravasation of hot acid waters or vapours which were sufficient to change the otherwise stable minerals in the gneissic rocks surrounding the area. Mr Holland's and my own researches on the other hand have simplified the matter considerably by the discovery that the rock forming the groundwork of the Chalk hills areas is entirely different from the surrounding gneissic rocks, that it is in fact, as has been described above, a nearly pure olivine rock in various stages of alteration. The fact of such an olivine rock having at one time been erupted into the older gneisses in this part of the country is in itself sufficient to account for the secondary masses of serpentine and veins of magnesite, without having recourse to hot acid waters emerging at particular places, inasmuch as it is the nature of olivine rocks to rapidly undergo changes into serpentine and magnesite. The mineral is of such an unstable nature as to readily lend itself to these changes under normal subterranean or surface conditions (without calling into play any special metamorphosing agents), whilst the ordinary gneisses of the country, and the less basic rocks surrounding the area remained practically unaltered.

I need say very little, therefore, as to the general occurrence of the magnesite here, except that it appears in veins which although they have, in places, a tendency to a particular alignment along what were probably originally joint planes in the dunite, are nevertheless as a rule completely irregular in their disposition. The number of veins and the corresponding quantity of the magnesite, were points to which I particularly directed my attention, and which I have endeavoured to represent on the accompanying map. The pale wash of blue which covers the whole area where the dunite is found, stands for that in which the magnesite is least in evidence or absent altogether. The cross shaded portion is that in which there is a fair amount of the magnesite, whilst the deep blue wash represents the parts

richest in magnesite. I have been compelled for diagrammatic purposes to draw the boundaries of the different areas as sharp, but I need scarcely remark that in nature there are no such hard and fast lines, the richer and the poorer rock grading into each other.

(1) The richest areas (coloured blue) are, generally speaking, the western end of the north area, and the south side of the south area I estimate that the proportion, by volume, of magnesite in the rock in these richest parts is about one half or one third of the whole rock

(2) The moderately rich area (cross shaded) occupies generally the more central parts of the Chalk hills, and I estimate that the proportion, by volume, of magnesite here is only from one-sixth to one-tenth, or even less, of the whole rock

(3) The poorest area (coloured pale blue) merely shows a few thin veins and patches of the magnesite here and there, and impossible of estimation

The total area embraced under heading No (1) above, in the two parts of the Chalk hills taken together, amounts to about 620,000 square yards, that under heading No (2) amounts to about 5,536,000 square yards

Considered altogether, the amount of magnesite in these hills is practically unlimited The richest portions (as visible at the surface) stand up in rough lumpy hillocks, sometimes, as in the case of the hills at the western end of the north area, rising as much as 100 to 140 feet above the plains, whilst in other parts, as the south edge of the south area, they rise only to 30, 40 or 60 feet above the plains Hence the mineral (if any demand for it ever does arise) can be worked in open quarries, and taken away to the rail The quarries could all be reached by a light tramway, or by carts

Two outline views of the two areas are appended to this report to show the configuration of the country, and two photographs to illustrate the surface appearance of the magnesite veins

(2) Kanjamallai area

Mr. Holland (*Rec G S of India*, vol XXV, p 142) was the first, I believe, to draw attention to the presence of ultrabasic rocks and magnesite in small amount at the north west end of the Kanjamallai hill in a depression at the head of a little

stream running down to Sithaswaran Kovil (temple) Therein also he remarks on the possibility of finding chromite associated with the magnesite

On visiting this part myself last season, I found the rocks as described by Mr Holland But the amount of the purer olivine chromite ultra-basic intrusive rock (dunite) as found at the surface was, however, extremely small It is of a pale greenish yellow colour and crumbles easily Veins of magnesite run through it. In close relation with it was a brilliant dark-green rock composed of enstatite and a bright green pyroxene (diopside), a rock which is also found in the extreme north east parts of the north magnesite area of the Chalk hills, on the east side of the double peaked Nagramallai hill (not represented on the map)

Mr Holland's prediction as to the possible finding of chromite here was verified by my coming upon a band of it about 4 inches thick among the magnesite and decomposed ultra basic rock It was only exposed for the short distance of about 3 yards

The whole exposed area of these rocks in this locality is in length not more than $\frac{3}{4}$ mile and in breadth $\frac{1}{4}$ mile It appears to follow round the eastern end of the depression at the north-west end of Kanjamallai in the angle formed by the main ridge and the low continuation of it south of Sithaswaran kovil (temple) I could not find any trace of it anywhere else on the Kanjamallai ridge

To the south of Kanjamallai hill, and running parallel to, and north of the Salem, Sankaridrug road, there is a little row of hills composed chiefly of talcose schists and dunite, with a mere trace of magnesite among them The talcose rock was locally worked as pot stone for making rude vessels (feeding troughs for cattle, etc)

Both these two areas are too small to be considered as of any importance from the magnesite they contain, but the chromite of the former, and the pot stone of the latter, may be considered as of some economic value The chromite is in close proximity to a thick bed of magnetite

This paper does not profess to deal with the iron ores of Kanjamallai, but I may mention that a few average specimens from the lowest and thickest band of magnetite schist at the

Hills near Salem (C S Middlemiss) | Magnesia

south foot of Kanjamallai were analysed in the Survey laboratory by Mr Blyth and gave —

No 10 212 (a fine grained, almost aphanitic rock, a large specimen of which I sent to the Madras Museum)—

Specific gravity	3 365
Per cent of iron	35 00

No 10 243—

Specific gravity	3 531
Per cent of iron	34 390

No 10 239 (a coarsely crystalline quartz magnetite rock)—

Specific gravity	3 538
Per cent of iron	36 66

(3) THE VALAIYAPATTI AREA

This locality is one of those described by Foote and King in their Memoir cited above, p 96 The amount of magnesite present is extremely small The ultra basic rocks which have given rise to the magnesite are the same as those last described from north west end of Kanjamallai hill, but I did not find any of the pure olivine rock analogous to the dunite of the Chalk hills

The actual locality is a little south (from half to one mile) of Palappatti of the one inch map of the Námakkal taluk (Madras Survey) The magnesite is exposed over an area of one mile by half a mile, and it is developed among rocks which contain a considerable quantity of enstatite, with green pyroxene (diopside)

Besides this particular area there is, actually at Valaiya patti, another occurrence of similar rocks, which stretch away in a long narrow band east and west of the town They form little hills rising sometimes steeply, and forming a discontinuous chain With them east of the town occurs a rock of an extremely acid type, a very coarse red or pink and white pegmatoid rock or graphic granite, composed of quartz and felspar, which have crystallised together simultaneously

From the point of view of this report I need not make any further remarks concerning this occurrence

These are all the localities with magnesite that I have so far visited The first is the only one in which the mineral is developed in sufficient force to be of any practical use

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N Summ t
Doub e Peak

INDEX

Dun te w th a l tt e Magnes te

Do, w th f om [illegible] to [illegible] Magnes te

Do w th from [illegible] to [illegible] Magnes te

Chrom te Ve n

Do n Ro nd egments

U t a-bas c O v ne Aug te and
O v ne Aug te Plag oc ase
Rocks

One st c Rocks, strik ng about NE S W
among wh ch the above rocks a e int us ve

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr George Watt, Reporter on Economic Products to the Government of India, Calcutta

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions Contributions or corrections and additions will therefore be most welcome

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry under the Forest Series, and those of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series

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This sheet and the title page may be removed when the subject matter is filed in its proper place according to the letter and number shown at the bottom of each page

...ral and Metallic Series, No 7.)

THE AGRICULTURAL LEDGER.

1896—No. 16.

(REPRINT FROM MADRAS RECORDS)

CORUNDUM.

(DICTIONARY OF ECONOMIC PRODUCTS, Vol II, C 1978)

REPORT ON CORUNDUM LOCALITIES IN SALEM AND COIMBATORE DISTRICTS

WITH A SUPPLEMENT THERETO.

By C. S. MIDDLEMISS, B A., *Geological Survey of India.*



Madras:

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

1896

The objects of THE AGRICULTURAL LEDGER are—

(1) To provide information connected with agriculture or with economic products in a form which will admit of its ready transfer to ledgers;

(2) To secure the maintenance of uniform ledgers (on the plan of the Dictionary) in all offices concerned in agricultural subjects throughout India, so that references to ledger entries made in any report or publication may be readily utilised in all offices where ledgers are kept;

(3) To admit of the circulation, in convenient form, of information on any subject connected with agriculture or economic products to officials or other persons interested therein;

(4) To secure a connection between all papers of interest published on subjects relating to economic products and the official Dictionary of Economic Products. With this object the information published in these ledgers will uniformly be given under the name and number of the Dictionary article which they more especially amplify. When the subject dealt with has not been taken up in the Dictionary the position it very possibly would occupy in future issues of that work will be assigned to it.

E. C. BUCK,
Secretary to the Government of India.

(Mineral and Metallic Series No 7)

THE

AGRICULTURAL LEDGER.

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CORUNDUM

[*Dictionary of Economic Products Vol II, C 1978*]

PRELIMINARY REPORT ON SOME CORUNDUM LOCALIT[IES] IN THE SALEM AND COIMBATORE DISTRICTS

Note by C S MIDDLEMISS B A *Geological Survey of India*

INTRODUCTION

IN this report I shall merely endeavour to give a concise account of such facts as to the distribution and occurrence of corundum in the districts referred to under the above heading, as have up to the present been investigated by me All discussion of theoretical questions arising from them, except in so far as such questions bear on the distribution of the mineral, will be left for a future more complete report, when these investigations have been brought to a close

A few remarks of a general nature have already been made by me in my progress report for the working season 1893-94, and reproduced in substance in the annual report of the Geological Survey for the year 1894 (*Rec G S of India*, vol XXVIII, pt 1, p 3), and in two letters to the Government of Madras, one dated 7th August 1894, and one dated 5th October 1894 I need not do more here than refer to them, as all important details contained therein will be embodied in the present report

Corundum localities visited by me

The following is a list of the localities where corundum has been examined by me —

(1) Sithampundi or Sittampundi, near Solasiraman (Sholasigamani), Námakkal taluk, Salem district.

(2) Paparapatti and neighbourhood, Dharmapuri taluk, Salem district
(3) Rengopuram, Dharmapuri taluk, Salem district.
(4) Road from Dharmapuri to Morappur
(5) Selangapalaiyam, Bhavani taluk, Coimbatore district
(6) Gopichettipalaiyam, Coimbatore district
(7) Karutapalaiyam, Coimbatore district

The following localities, though they have been quoted as corundum localities, have proved not to contain corundum in some cases, or else local information on the subject was found to be wanting —

(1) Yellagiri hills, near Jalarpet
(2) Neringipet, Coimbatore district
(3) Chinnamallai, Coimbatore district
(4) Kanjikovil, Coimbatore district

DESCRIPTIONS OF THE LOCALITIES

(1) Sittampundi area

This locality lies a little east of the Cauvery river, and about five miles to the south of the boundary dividing the Tiruchengodu taluk from the Namakkal taluk It has apparently been known for a very long time Specimens of corundum and of the enclosing rock from it were described by Count de Bournon (*Phil Trans Roy Socy*, 1802, p 282), and the place was visited by Captain Newbold and reported on by him (*Journal Roy Asiatic Socy*, vol VII, p 224) Lastly Dr Warth of the Geological Survey visited and reported on it in two letters to the Madras Government, Nos 540 and 606, dated 24th June and 16th July 1892, respectively

Area — The size of the area productive in corundum was given by Dr Warth as 771 acres, but the village officers gave 1,000 acres as the estimated amount It was also stated to be about four miles long and two miles broad in its widest part

The part examined by me was about two miles long and varied in width from 100 yards to 1,000 yards It lies south west, south, and south east of Sittampundi village, occupying a slightly elevated bit of rising ground running with its long axis west north west, east south east, at distances varying, according to the position, of from 1 mile to ½ mile from the village

It was in December 1893 that I began my corundum investigations in the district at this place first on account of its being the one about which most information was obtainable The following summary is based on the observations then made in the field, and on the subsequent examination of the rocks and minerals in the laboratory

Rocks of the neighbourhood.

The rocks to the north of the corundum area consist generally of a great series of biotite gneissic rocks, covering large areas, and with bosses and veins of a coarse reddish granite bursting through them and often forming picturesque crags and precipitous hills, such as that at Tiruchengódu town, and the similar hills in the vicinity

Actual matrix of the corundum

But the actual rock present at the corundum workings differs from the above in being a gneiss or gneissic rock, of a pale silvery or pearly grey colour, streaked with black and consisting of anorthite (Indianite) and hornblende, chiefly, with accessory minerals garnet, and minute quantities of chondrodite (?) In structure the rock is a crystalline granular aggregate of anorthite, with rather elongated prisms of hornblende, sparsely or numerously arranged with their long axes roughly parallel to the foliation

The rock is well foliated in bands which generally run perfectly straight, and which differ in the relative amounts of the pale mineral (anorthite) and of the dark mineral (hornblende) present (See Fig 1)

In some places the hornblende, in others the anorthite, make up nearly the whole rock Garnets also become locally very numerous The specific gravity of a specimen with but little hornblende and garnet was found to be 2 824 In this respect it closely resembles anorthite, the specific gravity being a little higher than that of the latter on account of the hornblende

It is among this gneiss that the corundum appears, dotted about at random among it like porphyritic crystals of orthoclase in a granite The mineralogical composition structure, and general appearance of the rock matrix here is plainly the same as that recorded by Count de Bournon from the Salem district, and named "Indianite" by him The microscopical examination of the two rocks shows them to be practically identical

Other minerals associated with the gneiss

In some sort of association with the anorthite gneiss, which is not disclosed by any exposures on the ground, there must occur a very coarse binary granite consisting of quartz and pink or flesh-coloured orthoclase felspar, inasmuch as large pieces of the latter, and beautifully clear smaller fragments of the former are found scattered over the ground in perfectly fresh lumps and showing no trace of rolling by the action of water.

On each side of the *in situ* gneiss, which forms the rising ground, there are gentle slopes of the same rocks, partly or wholly buried under surface material formed of the broken-up gneiss, and with here and there a recent calcareous pisolitic tufa, derived no doubt from the decomposition of the lime-felspar (anorthite).

The corundum of the area

The corundum occurs in two ways in the area :—

(1) In the bed-rock as described above.
(2) In the gentle slope of debris along with the weathered pieces of the bed-rock.

It is of a pale greenish-grey, rarely flesh colour, and occurs sparsely distributed among the parts of the gneiss which are richer in anorthite. It takes the form of irregular lumps averaging from one-fourth to one inch in diameter. They do not, as a rule, show the prismatic and pyramidal faces, though some specimens from this locality in the Survey Museum are in the form of short six-sided prisms, characteristic of corundum. They exhibit, however, rhombohedral cleavage, which may be detected as fine and very regular lines crossing one another at an angle of about 95 degrees, and ruled as it were at fairly regular intervals. These fine lines crossing one another in this distinct way are a good practical distinction in the field between this mineral and pieces of orthoclase, or other felspar, especially in the case of the flesh-coloured corundum, which at first sight may be easily confounded with the flesh-coloured felspar referred to in the previous paragraph. It is possible that some of the lines may indicate repeated twinning, but the difficulty of cutting microscope sections or of getting sufficiently thin cleavage flakes of the mineral, make it at present impossible to decide this point.

Nearly all these pieces of the mineral are surrounded by a shell of calcite, from one-fourth to one-eighth inch thick, in

which they lie among the matrix This shell appears to be left by the crystallising out of the alumina (corundum) from the lime-bearing felspar (anorthite)

The corundum found in the debris slopes is the same as that of the matrix rock inasmuch as the former is simply derived from the latter by weathering

Red corundum or ruby of the area

Besides the grey corundum noted above, and the flesh-coloured variety into which it passes, there are to be found fragments, generally minute, of red corundum, which very locally pass into ruby The brighter coloured pieces of these, which are but seldom larger than one fourth inch in diameter, were found by me only in the more hornblendic layers of the gneiss, and they lie in it surrounded by a shell of anorthite partly converted into calcite These pieces are not generally transparent, but dull and opaque, and of a red currant colour But here and there minute points of a fairly translucent red colour may be detected, and I have no doubt that occasionally rubies of value have been extracted from these rocks, as is reported traditionally and by Newbold (*Journal Roy Asiatic Socy*, vol VII, p 224)

Old corundum workings

The grey and the flesh coloured corundum are found all over the area to the south west, south, and south east of Sittampundi, referred to in page 12 The native workers have in some cases taken the trouble to break up the rock matrix along the more rocky parts of the rising ground, and so to extract the mineral from its shell of carbonate of lime But more generally it has been gathered by merely grubbing among the debris between the *in situ* outcrops and along the slopes Shallow excavations of this sort a foot or two deep are to be met with all over the area Women chiefly, but men also, take part in the search, which they conduct with the help of a small digging implement and a basket The searchers pick about among the talus until they find traces of corundum They then set to work to dig out a basketful of the material which is then gone over by hand, the fragments of corundum being selected readily and with certainty by those accustomed to the work

I was informed that the grey corundum was sold locally at the rate of eight seers for the rupee, and that a man can collect that much in about fifteen days The red corundum occasional clear ruby particles is more locally distributed,

Corundum	Corundum Localities in the Salem and

I only know of one set of small workings and pits at a point one and a half miles south-east by east of Sittampundi and south 8° (degrees) east of *Anagherry hill* *There are several* openings along one line of strike running north-west by west and extending for about 100 yards, but most of them have since been filled up by the falling-in of the sides One mine was about fifteen feet deep, cut out along the strike, and from two to three feet wide It had been much deeper (several yards I was told) but had subsequently been partly *filled in* with rubbish from above Two years ago, I was *told*, this mine was worked, and the red *corundum* sold in Tiruchengódu *for* 1, 2, 3 and 4 *rupees, according to the* colour, transparency, and size of the pieces Figure 2 is a rough sketch section of the mine

Emery

A piece of emery was picked up by me at the surface of the ground south-west of Sittampundi, but the rock was not found *in situ* anywhere

Uses of the corundum

There seems to be no doubt about the practical uses to which corundum can be put as an abrading and polishing agent by armourers and lapidaries in the country Mr Ball surmises (*Manual of the Geol of India*, pt II) that the consumption of corundum in India must be considerable, though, possibly it was larger formerly than now, as the trade of the armourer is possibly not so active now as it used to be

Quantity of corundum *available*

It is not possible without making some careful test experiments on a fairly large scale to say how much corundum, *relative to the* matrix, there is present I was only able to make the following experiments with a few coolies in collecting the mineral *from the surface*—

9 coolies working 6 hours gathered 4 lbs (size of pieces that of fine gravel)
Therefore 1 coolie „ 8 „ „ 0 6 lb

Another experiment gave these results—

10 men working 8 hours got 8 lbs or
1 man „ 8 „ „ $\frac{4}{5}$ lb

Another trial gave—

5 men working 8 hours got 5 5 lbs or
1 man „ 8 „ „ 1 1 lb

From these an average of about ½ lb for one coolie working one day can be deduced

If mining on a large scale in the bed rock be ever undertaken and found profitable, we might expect a gradual extension of the productive area by the laying bare of rocks along the same strike, [illegible] by enlarging the present area of solid rock exposed after the surface debris had been cleared away Hence my remarks [illegible] my letter to the Government of Madras of 25th October 1891, recommending that all facilities should be given to the [illegible] of the mines, so that their productiveness may be tested and data be obtained for future guidance Inasmuch as *the ordinary corundum occurs distributed in the bed-rock in* the manner I have indicated, and not in veins or lodes in small and restricted places, there is no probability that the mineral will suffer a rapid exhaustion, because it is certain that the part now visible above the alluvium is only a fraction of what lies hidden beneath it

Mining on a large scale

(2) *Paparapatti area*

Paparapatti lies ten miles north west of Dharmapuri town In a direct line, one and a half miles away to the west north west is a range of rugged hills, and between the two there stretches an alluvial plain with rock out cropping here and there Most of this plain is taken up with cultivation The corundum is widely distributed over the area As an indication of what is already known of its distribution, I have traced an outline map from the one inch Survey map and marked with red crosses the places where corundum has been actually seen and found by me It does not follow that this represents the limit of this corundum locality, but no information as to the extension of the areas could be obtained at the time of my visit, which was cut somewhat short by a pressing demand from the Madras Government to visit the magnesite area of the Chalk hills near Salem

As in the Sittampundi area, the surrounding rocks of this neighbourhood are gneisses, or gneissic rocks with biotite as the dark mineral present They are well foliated, with a foliation strike approximately N N E —W S W, that is to say, agreeing with the general trend of the hill range to the west

Nature of the neighbouring rock

Corundum. Corundum Localities in the Salem and

of Paparapatti. At the actual corundum localities there is, however, no appearance of a hornblende-anorthite rock such as is the matrix at Sittampundi. The rock, a biotite gneiss still, continues the same in character over the whole area, with the exception of a very local change, to be alluded to presently. Veins of a very coarse granite with red felspar and clear white quartz penetrate the gneiss, as well as veins of a closer-textured purplish granite. There are other intrusive veins of a dark compact trap.

The matrix of the corundum

The actual matrix of the corundum in this area is apparently an altered form of the biotite gneiss. Elliptical (in section) or lenticular portions of the gneiss appear to have had their minerals re-arranged and altered; the dark mineral biotite segregates into an outer layer surrounding the lenticular portion, whilst the central parts of it remain more purely formed of deep flesh-coloured orthoclase (finely crystalline, and showing under the microscope a fine micro-perthitic intergrowth of possibly plagioclase) the amount of which varies with the amount of corundum present. Along with this changed appearance of the gneiss the foliation of the rock in these lenticular patches becomes much less pronounced and occasionally disappears altogether.

The size of these patches is sometimes as much as 3 or 4 feet long by 6 inches or a foot across where actually seen in the rock; but that they are in some parts much larger is shown by the huge lumps of the changed rock found lying on the hill-side.

On the hill-sides W.N.W. of Paparapatti the *in situ* gneiss containing these presumably altered lenticles, with corundum developed additionally, may be seen but rarely. Even then the hill-side is so completely broken up and weathered into loose, tumbled blocks that it is quite impossible to get any approach to a natural section showing the true relation between the areas of altered and unaltered rock.

The corundum itself.

The corundum here differs entirely in appearance from that of Sittampundi. It is of a deep purplish-brown or sometimes dark greenish-grey colour, and it is always regularly crystallised into hexagonal prisms with a great number of variously inclined pyramidal faces imperfectly developed, and so giving the prism an elong-

ated barrel, or even spindle shape (see fig 3) These elongated prisms lie towards the central parts of the lenticular patches of changed gneiss last described, arranged in any direction, but generally with a tendency to an imperfect parallelism of their long axes with the long direction of the lenticle, which itself again is roughly parallel to the foliation of the surrounding gneiss

The size of the corundum crystals cleavage &c

In size they vary from extremely minute grains and crystals, only visible in a microscopic section, to large crystals several inches long and from $\frac{1}{4}$ to 1 inch in diameter The characteristic rhombohedral cleavage is easily made manifest by breaking the crystals and sometimes as in the crystal figured (fig 3) traces of the cleavage planes are visible on the prism faces Occasionally also a combination of the rhombohedron and prism may be seen in a single crystal

Shell of Orthoclase round the corundum

Besides the generally altered rock in which the corundum is embedded, each crystal is immediately surrounded by a shell of more compact orthoclase, generally flesh coloured but sometimes white, having a thickness of from $\frac{1}{4}$ to $\frac{1}{8}$ inch When a corundum crystal has been broken out or has dropped out from the rock, the place where it lay can always be distinctly recognised by this shell which remains behind

Arrangement of the corundum bearing rock in lines

It is clear from the map that the outcrops of the rock in which corundum occurs lie in successive lines, roughly parallel to the strike of the gneiss, namely, N N E—S S W This seems to show that the particular bed, or band, of the gneiss fruitful in corundum, is repeated by the foldings of the rocks, so that it appears several times at the surface Should this tentative conclusion be correct, it has a practical bearing on the amount of corundum in the locality, because it makes it very probable that the lines of fruitful rock which have continued as far as shown on the map will also continue further in the same direction in either continuous or broken outcrop

Native ways of obtaining the mineral

There are two ways of getting the mineral here corresponding to the case of Sittampundi, viz, (1) by working the bed rock and (2) by digging in the talus of debris at the foot of the hills and slopes No extensive working of the bed rock

Corundum

Corundum Localities in the Salem and

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has been practised, but the richer lumps have been broken up, when not too hard or too large for demolition by hand Numerous shallow pits in the debris and half decomposed rock have been made In general, it may be said that the mineral is gathered in an unsystematic, casual way, not as a regular *pursuit*, but *only during the hot weather or at times when the* soil from an agricultural point of view requires no attention, also during times of scarcity A good deal is also gathered at ploughing times and at any time, especially after rain, by being picked up when met with without special search By these means at certain times the mineral is accumulated and sold in the market as a regular article of commerce Merchants from Madras and Bombay, it is said, buy large quantities of it at intervals when the local collections have accumulated

Working on a large scale systematically

As in the case of Sittampundi, it is impossible to say whether working the mineral systematically would pay Such a question can only be decided by actual experiment carried on in such a way that the correct average percentage of corundum obtainable from a given amount of rock may be deduced Towards the south west of the corundum bearing area there is a stream of water which is said to be perennial This could be turned to account in sifting the more finely distributed particles of corundum in the matrix, after breaking up and gentle pounding These minute grains, at present overlooked, are as valuable as, or possibly more so, than the larger fragments, volume for volume, inasmuch as the corundum must first be reduced to the granular form before it can be used as an abrading agent

The area as a whole

On the whole this area near Paparapatti is a decidedly promising one The amount of corundum present in the rock appears to be sometimes considerable, and the area of known outcrops is a large one

(3) *Rengopuram*

Locality limited

So far as I know personally, and also by report, this locality is an isolated and limited one At the same time it should be remembered that negative evidence goes for very little in such a matter as the recognizing of small pieces of corundum, and especially in uncultivated forest land, where the soil is never disturbed

The actual place of the corundum is two miles N by E of Rengopuram, a village on the outskirts of the forest land near Penagaram

Two pits

Here are to be seen two pits a few yards apart The newer of the two is about 15 feet long by 8 feet broad, and 5–8 feet deep, and is sunk through a rock composed of alternate layers of a felspathic rock and a hornblende gneiss I could find no corundum in the rock itself, although I made a careful and prolonged search The villagers and servants with me were equally unsuccessful The mineral was, however, abundant in the surface debris overlying the edges of the mine It is possible that this surface material may have come from a more distant point by a movement of soil cap down the slope The difficulty was to account for the mine which had been carried down some distance into the bed rock

The corundum colour form &c

The corundum here is of a greenish grey colour and is very much rounded and waterworn into holes, and even slightly honey combed (facts supporting the belief that it came from some distance) Hexagonal short prisms were the prevailing forms which it assumed, and most of these showed a tendency to break up parallel to the basal plane, thus forming irregular plates There is no good basal cleavage, however, the rhombohedral cleavage being the only noticeable one

(4) *Road from Dharmapuri to Morappur near 6th milestone*

The first of the two localities embraced under the above heading lies one mile south of the 6th milestone from Dharmapuri, at the foot of a low hill a little west of the foot path The nature of the rock and the mode of occurrence of the corundum resemble entirely those of the Paparapatti area The exposure shows signs of having been worked within a radius of a few yards I could not find, nor hear of any other exposures of the same rock in the neighbourhood The low hill range west of the Mukkunur range and that range itself are petrologically of different constitution Here as before, however, negative evidence counts for very little A band of the corundum-bearing rock may continue from this outcrop, though hidden from view at present

The other locality is two miles north of the same milestone There is no good exposure of the rock A few fragments in a field alone reveal a few bits of corundum of a dark grey colour set in a very fine-grained fissile rock almost resembling a phyllite or schist

(5) *Selangapalaiyam*

Locality

The first locality I visited in Coimbatore district was the above The corundum occurs scattered in fragments and rolled pieces in a field extending from near Chinnanayakkanur to Selangapalaiyam

Nature of the enclosing rock

The solid rock of the neighbourhood is very imperfectly seen There are no rocky masses and no quarries So far as one can gather from fragmentary observations, the rock of the country here is a muscovite biotite gneiss, with wavy foliation, and with veins of a coarse binary pinkish graphic granite pene trating it irregularly

The corundum and mode of gathering

The fragments of corundum are of a pale greyish green colour, sometimes brown outside It has no crystalline form, but is in irregular lumps varying in size from ¼ inch across to 1 and 2 inches across Nearly all are rolled, but the rhom bohedral cleavage is generally distinguishable

The village karnam of Selangapalaiyam informed me that it [illegible] t picked up from the fields, [illegible] Perhaps 25 or 30 maunds

(6) *Gopichettipalaiyam*

Locality

This is a limited locality like the last and is simply a field, from the surface of which the mineral is gathered The village magistrate owns the field, No 94, which is about half mile north of the travellers' bungalow

Bed rock Corundum

The only rock seen *in situ* was a disintegrated and much altered hornblende gneiss The corun dum is of a dark brown colour, more nearly resembling that of Paparapatti than anything else There was a fairly large quantity of it scattered over the field, the few of us present easily picking up pieces of the size of

walnuts Old picked over heaps of rubbish lined the edge of the field The Revenue Inspector informed me that this was the only field near in which the mineral was found, that a contractor from Madras came annually and took away all the corundum he could find, that the latter employed 30 or 40 coolie women who worked for three months last year (1894) and collected altogether two large cart loads, that each woman could collect $\frac{1}{2}$ to 1 Madras measure (= Rs 80 weight) every day.

This field struck me as being singularly productive The rock beneath is probably very rich

(7) *Karutapallaiyam*

Locality

The above village lies about two miles W N W of Sivamallai, a prominent temple crowned hill in the Kangyam taluk Between the village and the hill there stretches a row of six or seven small rocky hillocks composed of the same gneiss as the hill itself The hillocks in fact are structurally a W N W continuation of the Sivamallai mass

The neighbouring rocks

Two rocks of different composition and structure are connected with the appearance of corundum at this place The one is the pale grey gneiss of the Sivamallai hill, and the other a coarse granite intruded as veins into the gneiss

The former is a very felspathic rock which in appearance resembles the anorthite rock of Sittampundi It is composed almost wholly of plagioclase felspar and microcline in a granular condition A small quantity of biotite or of hornblende and iron oxide, with another minute mineral in small octohedra, zircon (?), occur as accessories The last was brought to me as corundum by some of the Sivamallai villagers

The whole rock weathers into large pale ochre coloured blocks forming small tors

Along the northern foot of these hillocks, between Karutapallaiyam and the Tiruppur-Kangyam road and extending for a distance of one mile, there are a series of holes and trenches made by the owners of the lands, which reveal the coarse granite alluded to above It is a dark red, white, and black non-foliated rock, composed of red or deep flesh-coloured felspar

which is a form of orthoclase with minute intergrowths of probably plagioclase, quartz in sometimes very clear lumps, and biotite in large nests of small plates

The corundum occurring in the coarse granite

It is in this extremely coarse red granite that the corundum is found as large well preserved six-sided crystals of a dark or light greenish-grey colour The mineral appears in this completely unaltered rock as if it were a normal mineralogical constituent, or at least accessory, of the granite It possesses no shell of any other mineral as in the case of the Sittampundi and other localities where the corundum is found in its matrix There is nothing to suggest in this case that the corundum was formed subsequently to the matrix in which it lies, nothing to suggest a secondary origin for it

This area is still under investigation, but in the meanwhile it is noteworthy that the corundum is dug chiefly in the granite along the line of contact (or very near it) with the gneiss

This is not the place to introduce theories, but should the mineral be afterwards shown to be a contact phenomenon, then its presence in the gneiss at Sittampundi as a secondary mineral, and its presence in the granite of Sivamallai as one of the same age as its matrix, would be explained

Mining the corundum numerous holes and trenches

The mining or digging out of the corundum near Karutapallaiyam is quite an active industry (1895) on a small scale The fields on the northern side of the row of rocky hillocks of waste land have been taken up, not for the purpose of cultivation, but for corundum mining There are a number of irregular holes and some few regular trenches, the latter following W by N —E by S (the direction of strike of the gneiss and of the intrusive veins of the granite) or at right angles to this direction One of these was 30 yards long, 2 yards wide, and 20 feet deep Another trench was dug along a direction N E by E for 15 yards It was 20 feet deep and 2 yards wide, and it followed the junction of the granite with the gneiss which here dipped 60° N W The largest and most productive working was close to the village of Karutapallaiyam Here were obtained some very large crystals of corundum 6-8 inches across I was shown a basketful of the mineral weighing about 14 seers (28 lb) gathered during the day of eight hours by four men, their wives and little children.

A past generation are reported to have made a very good thing out of the corundum of this place, when the stuff sold for Rs 40 per podi = 192 *Madras measures* Now, I was told, only Rs 30 would be obtained for the same amount, I cannot say how much confidence is to be placed in these figures

On the whole I think this locality is perhaps the most promising that I have so far seen It is the only one I saw in private land that was in active working

Other localities near this place

At Padyur, Shigrispalaiyam and Kundyankovil in the vicinity the mineral is reported They will be visited in due course

SUMMARY AND GENERAL REMARKS

Varied matrix of the corundum

From the preceding account, it is clear that the corundum deposits of Salem and Coimbatore, so far as they have been at present examined, are not confined to one well marked stratum of rock, of a constant composition and definite horizon The matrix may be, as we have seen, (1) anorthite gneiss, (2) orthoclase gneiss, (3) a fine grained schist, (4) a coarse graphic granite

Thus the nature of the bed-rock of any area would not be a guide as to whether corundum might be found there or not

It seems possible, however, that the presence in or near of a coarse granite, intrusive among the bed rock, does represent a condition without which corundum fails to appear Further discussion of this point is reserved at present

Mode of distribution of the mineral in its various matrices

A scattered distribution

Throughout the seven areas already examined the mode of distribution of the mineral in the matrix is generally the same, that is to say, it is a scattered distribution, the crystals or lumps or grains are dispersed at intervals through the rock like plums in a pudding, or porphyritic crystals in an igneous rock The particulars of this distribution in the various cases under notice are of practical importance (1) The richness of the rock varies within certain limits (which cannot be obtained without a prolonged practical test) (2) The presence or absence of a shell of a softer mineral, *e g*, calcite round the corundum, determines the ease or otherwise with which it can be extracted pure from the rock For

instance the Sittampundi rock is poorer than the Karutapallaiyam rock, but the former can be got out nearly pure whilst a heap of the latter is generally half felspar

No beds of massive corundum as at Rewah

Nowhere in the areas that I have seen does the mineral become massive and aggregated into layers or beds as in the well-known Rewah deposits of Pipra, described in 1872–1873 by Mallet (*Records G S of India*, vol V, p 20, and vol VI, p 43), where a bed of several yards thick (maximum thirty yards) is traceable for ½ mile

As all corundum must be reduced to a granular coarse powder before it can be used by lapidaries, &c, it is open to question whether a scattered distribution or a massive occurrence is the more easily manipulated form Massive corundum would certainly present difficulties to the simple form of working adopted at present by the natives of Salem and Coimbatore

It may be mentioned that the so-called "sand vein" of corundum at Culsagee and Laurel Creek, United States, which is loose and incoherent, and can be worked by the hydraulic process, is preferred to the more massive crystalline lumps, as it saves the labour of pulverizing (see *Mineral Resources of U S*, by T M Chatard, p 714)

Gem forms of corundum

At Sittampundi, rubies have been found as detailed before in this report Sapphires are also mentioned by Newbold as having been found in the valley of the Cauvery (*Journal Roy Asiatic Soc*, vol VIII, p 153) This is rather a wide field, and so far I have been unable to corroborate the statement

Corundum occurrences in these districts similar in appearance to that of the sapphires in Zanskar

It may be mentioned, however, that the form and shape of the crystals in the Paparapatti and Karutapallaiyam areas and their mode of distribution very much resemble the like conditions under which the sapphires of Zanskar in Kashmir appear In our area the colours differ by being of a dark greenish or reddish grey, whilst in Zanskar, they are of a bluish grey, which locally becomes a deep violet-blue (sapphire) The colouring of such minerals, depending as it does on accidental impurities in them, may easily vary The finding of sapphires in the corundum areas of Salem and Coimbatore is therefore quite possible

Coimbatore Districts (*C S Middlemiss*) | Corundum

Inexhaustible supply of corundum

The mode of occurrence of the corundum in Salem and Coimbatore in rock masses which appear only at intervals above the alluvium, but which have a very extended distribution, shows that the area of productive rock is practically inexhaustible As a petty article of commerce, therefore, so long as corundum is used in the arts, it will be worked in a desultory way Whether it will ever rise to be an important item in the trade of the Presidency or not, depends on so many causes and conditions of demand, labour, opportunity, fashion, capital, boom, &c, that I can give no opinion thereon

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SUPPLEMENTARY REPORT ON SOME CORUNDUM LOCALITIES IN THE SALEM DISTRICT

TOWARDS the end of last field season, whilst traversing from Hosúr to Royakotta, I found the biotite gneiss and the associated rocks and minerals gradually becoming more and more similar in character to those already observed by me near Paparapatti, where an extensive zone of my previous report) nt enquiries for corun I was shown several places a little east of that town where corundum was to be found As the field season drew to an end, I was joined by Sethurama Rau, apprentice and to him I entrusted the linking up of these Roya kotta corundum areas with those of Paparapatti In this he was fairly successful The following notes are combined from his observations and mine along this line of country —

The finding of these new localities entirely confirms a conclusion I had already arrived at as to the distribution of the corundum namely, that the gneiss fruitful in that mineral occurs in bands repeated by foldings of the rocks, and that very probably the lines of fruitful rock, which had continued as far as shown on the map, would continue further in the same direction in either continuous or broken out-crop (pp 18, 19 of my previous report) In the tracing of part of sheet 27 of the Salem Topographical Survey given with my former report, the area of corundum-bearing gneiss is shown to extend lengthwise for a distance of 8½ miles from near Ponnurnattam to the latitude of Pálakódu The new observations carry on this line in broken con tinuity as far as a little north of Royakotta, making altogether a zone or strip of productive rock of about 24 miles in extent Nevertheless a considerable gap occurs from near Chenampalli to about 1 mile south of Royakotta, where, so far, no corundum has been detected (It does not follow that it is altogether absent)

The new localities are enumerated below in order from south to north, that is, from Pálakodu to Royakotta —

DHARMAPURI TALUK

(1) *About 1 mile west of Kodiyur or 2½ miles north-north-west of Pálakódu* —Here occurs a series of hillocks stretching nearly north and south for a mile At the south end of this line of hillocks, corun dum is found in a dark gneissic rock containing (microscopically) biotite and muscovite as well as iron ores and ? zircon Along the western scarps of the hillocks corundum is easily picked up loose in the fields, the colours being dark brownish and greenish gray and the forms the same as those of the Paparapatti area At the top of one

Coimbatore Districts (*C S Middlemiss*)	Corundum

of the hillocks with a deserted temple called Pamasawaram mallai, corundum is found *in situ* in gneiss like the Paparapatti gneiss, and sometimes in large crystals 1 to 2 inches long, surrounded by a thick covering of small biotite crystals The corundum was said to have been worked here by being picked up from the soil

(2) *Village south-east of Sanganbasavanatalao* (tank) —Here a few crystals of corundum were found in the soil

(3) *Deserted village of Sennakesavapuram* —At this place, which is near the last, corundum was also found loose in the fields in the form of freshly-broken crystals which had evidently come from rock close at hand.

KRISHNAGIRI TALUK.

(4) *A little west of Jaggasamudram* —From the last locality (3) the line of strike crosses over the boundary into the Krishnagiri taluk Here pieces of rock in the fields were found to contain corundum The matrix is a white very felspathic gneiss with a fair amount of biotite and muscovite in very small plates The corundum was surrounded by a shell of white felspar similar to that of the Paparapatti area It was stated by the villagers that there were old diggings here 9 feet deep with galleries below

(5) *A little south of Suneri* —Corundum was picked up in loose

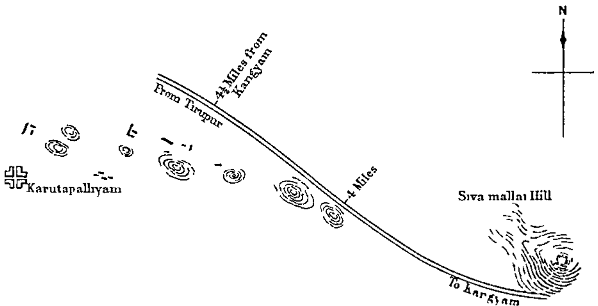
as at (5) Be
otta observations

The next locality is—

(7) *One and-a half miles east-south east of Royakotta* —On the bridle road which cuts off a sharp turn to the north of the Royakotta Krishnagiri cart road, and in the vicinity in the low scrub jungle to the north, corundum can be picked up in small water worn fragments and prisms None was found in the gneiss *in situ*

(8) *Guntapalli Village* —This place is on the Royakotta Krishnagiri road about 3 miles from the former place The corundum here is similarly picked up in rolle
south and west of the town
gneiss, some of which is tr
made

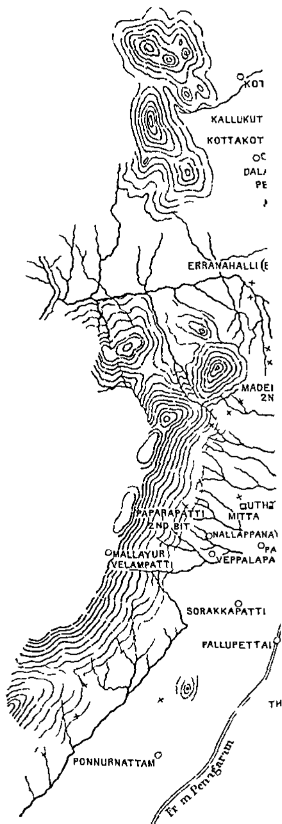
(9) *Chintalkutta Village* —This village lies about 2 miles north-east by east of Royakotta The corundum here occurs in the same way as at the last two localities



ROUGH PLAN OF THE
CORUNDUM DIGGINGS
NEAR
KARUTAPALLIYAM

CORUNDUM HOLES
AND TRENCHES
MARKED IN BLACK

Middlemiss Report on some Corundum Localities



Middlemiss Preliminary Report on some Corundu

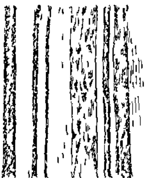


FIG 1

BANDED ANORTHITE
HORNBLENDE
GNEISS

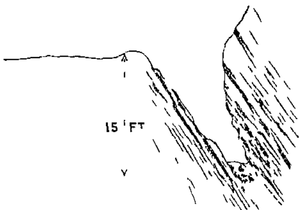


FIG 2

RED CORUNDUM
MINE
(Section across)

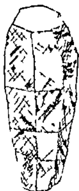


FIG 3

CRYSTAL OF
CORUNDUM

Middlemiss Report on some
Corundum Localities

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr George Watt, Reporter on Economic Products to the Government of India, Calcutta

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions Contributions or corrections and additions will therefore be most welcome

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series Thus for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry under the Forest Series, and those of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series

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This sheet and the title page may be removed when the subject matter is filed in its proper place according to the letter and number shown at the bottom of each page



(Implement and Machinery Series, No 3.)

THE

AGRICULTURAL LEDGER

1896—No. 17.

(REPRINT FROM THE MADRAS BULLETIN No 32)

AGRICULTURAL IMPLEMENTS.

(WATER-LIFTS)

(*DICTIONARY OF ECONOMIC PRODUCTS, Vol I, A 64*

EXPERIMENTS ON WATER-LIFTS

By A. CHATTERTON, Esq., B Sc.



Madras.

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

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EXPERIMENTS ON WATER-LIFTS

By A CHATTERTON, ESQ, B Sc

With reference to G O, Mis No 725, Rev dated 16th February 1895, the Committee thereby appointed begs to submit the following report

Mr E W Stoney's lift with automatic tilting buckets
Sultan Mohidin Sahib's water lift
M R Ry C K Subba Rao's see-saw water lift

The instructions to the Committee were to report, after trial, on the relative merits of the three water lifts noted on the margin From the correspondence recorded in Board's Proceedings, Nos 1178, 1398, 1788 and 2419, Mis, of 1895, Government will have learnt that Messrs Sultan and Co were not prepared to submit to the Committee for trial the "Sultan" water lift patented by Sultan Mohidin Sahib, and the Committee accordingly did not test that lift Mr Stoney's water lift was not ready for experiment at Saidapet until the middle of July, and on that date the see saw lift, which M R Ry Subba Rao voluntarily undertook to erect there at his own cost, was still unfinished To avoid further delay, the Committee therefore proceeded to experiment on one of M R Ry Subba Rao's lifts that had been erected at the Luz Shortly before the actual trials took place, M R Ry C K Subba Rao constructed an improved single mhote lift which he has devised, and this was also tested

The Committee submits a report (with drawings of the lifts) prepared by Mr. A Chatterton, which is so complete that it leaves little room for further remark

The essential novelty of Mr Stoney's lift lies in the automatic tilting iron bucket The trials showed that this bucket works very efficiently It is as suitable for use with the ordinary country lift as with a winm, and, as there is none of the leakage which is inevitable

with buckets made of leather, or fitted with valves, its superiority over leather or valve buckets becomes greater as the depth of the well increases The lift taken as a whole also gave good results on trial, and might have been worked with a much smaller bullock

M R Ry Subba Rao's see-saw lift can be used with any bucket The iron bucket with a leather discharging trunk used during the experiment was not in good order This lift also gave remarkably good results, but, as pointed out by Mr Chatterton, the design cannot as yet be regarded as having reached its limit of perfectibility Its merits are described in Mr Chatterton's note, and mainly lie in utilising the force exerted by the bullock and driver in ascending an inclined plane It is in its essence a picottah in which one bullock, by its mere weight, does the work of several men As the length of the oscillating platform must be limited by considerations of weight and cost, the design is not adapted for wells in which the water is more than 30 feet below the ground level

Regarding both the above lifts, the Committee is of opinion that whilst they are much more efficient than the single mhote, and whilst they, in common with the double mhote, cause much less wear and tear on the bullocks employed, it would require more skill to erect and keep ... in up-country villages, ... this work, their train- ... st of the lifts, it is not ... the Committee consider that either might be put up for about Rs 150, though the charges for Subba Rao's lift would vary greatly according to the materials locally available Where palmyrahs are plentiful and cheap it might be possible to design and erect a see saw platform at a cost well within the means of the ordinary ryot It must be remembered that the ordinary single mhote, as used in Southern India, does not cost more than about Rs 20

As regards M R Ry Subba Rao's new lift, wherein the action is the same as in the single mhote, except that the weight of the bucket is counterbalanced, and the bullocks are enabled to reverse at the end of the incline and walk up the slope, the Committee is of opinion that, where cattle labour is scarce, the contrivance should prove most valuable, being well within the means of the ryot, and within the capacity of the village artisans to erect The Committee considers that Mr Subba Rao is deserving of great commendation for the ingenuity and ... improved water-lift, ... the disadvantage of

(Signed) H M WINTERBOTHAM
(,) C BENSON, M R A C.
(,) A CHATTERTON, B Sc.

MADRAS,
22nd *August* 1895

A. 647

Mr CHATTERTON'S REPORT

Three water lifts were submitted to the Committee for trial (1) a water lift with self tilting buckets by Mr E W Stoney of the Madras Railway, (2) an improved single mhote by M R Ry Subba Rao, (3) a water-lift worked by an oscillating platform also by M R Ry Subba Rao The Committee also experimented on the old double mhote erected at the Saidapet farm about twenty years ago, and which in its present condition represents the average of high class water lifts working in

on

ower

the

investigations necessary to form an opinion on the matter submitted to them by Government, determined to remedy this as far as possible, recognizing that the only way in which improvement can be effected is by the compilation of accurate data regarding the different types of water lifts already in existence The experiments conducted by the Committee had the following objects in view —

The determination of—

(1) the quantity of water and the effective height it was lifted in a

in a

(2) the qu

the same time,

(3) the quantity of work which might have been obtained from the animals in the same time had the working of the lifts been continuous

The first quantity divided by the second gives the mechanical efficiency of the water lift and the first quantity divided by the third gives its absolute efficiency as a machine for utilizing animal power in a given way

(4) The quantity of work represented in the water lifted per hour divided by the weight of the bullocks in lb

This yields a constant wh ch on the ass mpt on th at the

employed in working the

a comparison to be made be

very different methods of

ue

weight are utilized whilst in a

made use of as in Mr Subba

Rao s oscillating platform and between such very different methods the constants yielded by (4) seems to be the best method of making comparisons of the actual value of different machines for lifting water

assumption that the strength of animals is proportional to their

which is probably roughly true for animals in good working

and in the prime of life, and on the accuracy with which it is possible to estimate whether two animals working in different ways are exert-

machines for lifting water.

Methods of measurement employed in the experiments.—All weights were determined and draughts measured with a Salter's spring balance, recording to 500 lb and indicating differences of half a pound, which, previous to the commencement of the experiments, was tested with dead weights in the College of Engineering and found to be accurate The quantities of water raised were measured in the case of Stoney's lift by counting the number of buckets emptied and multiplying that number by the contents of one bucket As there was no leakage, it was found that each bucket came up with practically the same quantity of water in it, and by weighing that quantity it was possible to obtain a very accurate determination of the total quantity of water raised. In the other lifts, iron buckets with leather discharging trunks were used, and, as they all leaked to a certain extent, the quantity of water raised was determined by multiplying the total number of lifts by the average quantity lifted in a single bucket obtained by taking the mean of a number of buckets measured in an iron tank capable of holding about 250 gallons Speeds and times were measured with a stop-watch recording fifths of seconds. Measurements of draught and friction were made by inserting the spring balance, which was used as a dynamometer, in the line of action of the forces exerted by the bullocks and employing a number of coolies to work the lifts in their place In machines like water-lifts, which, of necessity, are somewhat roughly constructed, no great amount of labour is expended on fitting the moving parts together, and in consequence the working is not perfectly smooth and the friction varies considerably in a single operation of the machine The measurement of draught is therefore not very easy, and the results given below are, in every case, the mean values obtained from a large number of observations.

... feature in this lift (Plates II and

rawing, and the lower ends of the

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out of the water till the *discharging level* is reached, when the upper side of the inclined mouth comes into contact with an iron bar fixed

across the framing of the lift, and the stirrup, continuing its upward motion, causes the bucket to revolve about the point of contact of the bucket with the iron rod, and thus discharge its contents into the delivery trough The lift, as arranged at Saidapet (*vide* Plate I) during the trials conducted by the Committee, was worked by carrying the ropes which hold the buckets over guide pulleys to a whim turned by either a pair of bullocks or a single bullock Two buckets were attached and the ropes arranged, so that as one bucket ascended the other descended and the dead weight of the buckets was balanced The whim consisted of a drum built of wood and carried by an iron spindle on the top of a post firmly built into the ground The bullocks worked at the end of a long arm, the circumference swept out by which was 3 85 times the circumference of the drum The whim is worked alternately in one direction and the other, the cattle being made to turn round whilst the bucket is discharging its contents The lift was provided with two sets of buckets of a nominal capacity of 30 and 25 gallons respectively. In the following table is exhibited the data regarding their capacity —

TABLE I

—		Weight empty	Weight of water when full	Weight of water delivered by buckets
		LB	LB	LB
30 gallon buckets	No 1	101	296	280
	No 2	98	29.	280
25 gallon buckets	No 1	68	245	230
	No 2	67	237	230

The capacity of the lift was tested by working it with a single Nellore bullock weighing 1 146 lb on three different days, but, owing to insufficiency of water in the well, no test could be continued for more than 2 hours 42 minutes In table II the results obtained are shown

TABLE II

Date	Time started	Time stopped	Number of buckets raised		Lift at beginning	Lift at end	Mean Lift	Gallons raised per hour	Foot pound of useful work done
16-7 95	8-37	9-37	88	30 gal buckets	22 0"		2? 62.	2 594	586 900
	9-37	10-07	51			23 3"			
	2 4	3 4	91		21 10¼"				
	3 1	4 4	86				23 24	2 489	575 600
	4 4	4-40	63			23 6"			
17 7 95	2-0	3-0	85		22' 2"		22 87	2 391	516 900
	3 0	3 51	73			23 6¼"			
18 7 95	2 29	4 29	167	25 gal buckets	22 2"		22 75	1 88[illegible]	4 9000
	4-29	5 29	79			23 4"			

The results obtained with the 25 gallon buckets compare unfavourably with those obtained with the 30 gallon buckets as the animal employed was evidently not doing as much work as he might easily have done. His natural gait determines the number of lifts he can make per hour and the number is practically the same with the smaller as with the larger buckets. He could easily lift the 30 gallon buckets; a smaller animal should therefore have been employed to work the 25 gallon buckets.

The following observations were made on the draught required to work the lift and the friction when working. The length of rope to go once round the drum was 19.33′ and the circumference of the path in which the bullock walked 74.33 so that the velocity ratio was 3.846. With both buckets empty, it was found that a weight of 30 lb. placed in one bucket was sufficient to overcome the friction and cause that bucket to descend and the other to ascend at a uniform velocity. With 28 gallons of water in each bucket, 52.5 lb. was found necessary to set the whole water lift in motion at a uniform speed. To work the lift at about the speed at which it was worked by the single bullock, it was found necessary to exert a pull of 92 lb. at the end of the lever attached to the whim, whilst a pull of 87 lb. was found sufficient to just set the buckets in motion. With one bucket full and the other empty, it was necessary to exert a pull of 57 lb. at the end of the lever arm to prevent the full bucket from falling back into the well. Half the difference between 87 and 57, or 15 lb., represents the pull that is required to just overcome the friction of the mechanism. The mean between 87 and 57, or 72 lb. represents the pull which must be exerted to raise a full bucket neglecting friction, and this quantity multiplied by 3.85 should be equal to the weight of water in the bucket, viz., 280 lb.; actually it is equal to 277 which is a very accurate result considering the roughness with which the apparatus is constructed. From these figures it is easy to deduce that the mechanical efficiency of the lift when just moving is 83.6 per cent. and at the ordinary working speed 79 per cent. It was found that the speed at which the bullock walked when exerting a draught of 92 lb. was as the mean of a number of observations 3.646 feet per second and that in 162 minutes he raised 240 buckets of water, lifting each bucket 23 feet. Walking at this speed without stopping, which without doubt the animal could have easily done, he could have lifted 401 buckets so that he was only usefully employed for 59.7 per cent. of the time. The absolute efficiency of the lift was therefore 0.79 × 59.7 per cent. or 47.2 per cent. This calculation neglects to take into account the extra pull which is necessary to tilt the bucket to make it discharge, which was found to amount to 122 lb. and which was exerted through about 3 feet. This quantity would only affect the result very slightly and the decrease in efficiency would diminish as the height to which the water has to be raised increases.

Improved Single Mhote of M. R. Ry. Subba Rao.—The improvement (Plate IV.) on the ord [illegible] rope to the draught rop [illegible] of windlass erected at [illegible]

able height above the level of the end of the run Cords wound round two smaller drums one on each side of the large drum carry weights, which it was found almost balanced the weight of the empty bucket, so that at the end of a lift, as soon as the bucket was empty, the draught rope automatically rose in the air and the bullocks were able to turn round and walk up the inclined plane in a natural easy manner instead of being forced backwards as is the common plan The improvement effected is undoubtedly a very great one, as not only is the weight of the empty bucket practically balanced, but the animals are also spared the cramped and unnatural backward walk up a steep incline which probably tires them more than their exertions in drawing the bucket out of the well The experiments made on this lift were not very extensive, but the following results were obtained and are worthy of record The mhote was worked by two bullocks weighing 732 lb and 616 lb respectively, or in the aggregate 1 348 lb The bucket which was of iron and fitted with a leathern discharging trunk, weighed 43 lb and when full held 31 gallons of water, but the mean quantity

est being
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feet, the
t-lb per
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lift was
ulst the bullocks exerted a pull of 383
having to be raised an extra 2½ feet
tents and the work done is equal to
had to return up a gradient of 1 in
expended 6 510 ft-lb of energy in

lifting their own weight against the action of gravity The total amount of work done by them in a single lift was therefore 16,270 ft-lb and the useful outturn 5,570 ft lb, so that the efficiency of this method o nt As compared with the e which this lift possesses at the bottom of the inclined plane and ascend walking forwards instead of backwards, an advantage which it but the balancing of the bucke lb and increases the efficiency rhaps a very large amount bu

See saw water lift of M R Ry Subba Rao —An attempt was made to erect one of these water lifts at Saidapet, but it was not ready at the time of the Committee's trials and in its place Mr Subba Row asked the Committee to report on a lift which had been in use for some months in a garden in the Luz In this form of water lift (Plate V), the bullock is made to walk along a platform supported on a roller, and by his weight it is caused to oscillate up and down Two ropes are attached to one end of the platform and wound round two small drums forming part of a species of windlass, round the large drum of which a rope working an ordinary single mhote is passed The platform is not supported

in the middle, but at some distance therefrom, so that the working end of the platform greatly preponderates and the bullock has to walk to the free end of the platform to tilt the longer segment up and lower the bucket into the well The platform is 24 feet long and the supporting roller is fixed 15 feet 3¾ inches from the working end It was not possible to weigh the platform, and calculations of its weight based on the quantity of timber used in it can only be approximate It was however carefully measured up, and assuming that the teakwood, of which it was constructed, weighed 45 lb per cubic foot, the weights of the two sections are 1,450 lb and 850 lb To diminish the shock when the free end falls and the bucket is lowered into the water, 230 lb of iron rails are fastened underneath the platform by a short chain, so that just before this end of the platform reaches its lowest position, the rails rest on the ground and their weight ceases to act, and the platform comes to rest more gently than would be case if the velocity of descent continued to accelerate to the very end. The ropes from the platform were wound round drums, the circumference of which was 3 feet 2½ inches as measured by unwinding one coil of the rope, and the mhote rope was worked from a drum 7 feet 10 inches in circumference, so that the motion of the working end of the platform was multiplied 2 443 times With the bucket empty and the platform horizontal, the load at the free end could be varied from 160 lb to 362 lb without disturbing the equilibrium, whilst with a load of 247 lb in the bucket equal to 24 7 gallons of water, the platform remained horizontal, though the load at the working end varied between 584 lb and 275 lb Taking the mean between the two extreme values to be the actual weight required to balance the platform, it is possible by taking moments about the centre to determine the only force acting on the platform which was not measured, viz, the weight of the empty bucket and ropes acting with a leverage of 2 443 to 1 With the bucket unloaded, the weight works out as 65 4 lb and when loaded, 62 lb—a remarkably close agreement The lift was worked during the trial by a bullock weighing 700 lb and a man weighing 117 lb The rate of working was 81 lifts per hour from a well 18 1" deep The average quantity of water brought up by the bucket, as measured into a tank, was 23 5 gallons, and the useful work done per hour amounted to 344,210 ft-lb The bullock and the man together were much heavier than was really necessary, and they did not use the full length of the platform so that it is difficult to estimate the work done by them in working the lift, but the mechanical efficiency of the lift on the day of the trial can be ascertained by multiplying the fall of the front end of the platform by the force required to set it in steady motion when lifting a bucket full of water The total height the bucket had to rise to discharge its contents was 22 feet, and the end of the platform therefore fell 9 feet and the work done was $584 \times 9 = 5,256$ ft-lb To raise the platform back to its initial position, the free end then falls 5 18 feet and the load on it is 362 lb and the work done is equal to 1,875 lb The total work therefore done in a single lift is 7,131 ft-lb, and the useful work given to the water is 4,245 ft-lb, so that the mechanical

efficiency when just working is 59 6 per cent , at the normal rate of working it is much lower, probably not more than 50 per cent

The double mhote at Saidapet —This water lift is described in the *Saidapet Farm Records* by Mr C Benson and though not in very common use in the Presidency is sufficiently well known to need no description The details and general arrangement are shown in Plates I and VI This lift was worked by the bullock that was employed in the experiments on Mr Stoney's water lift and as the draught was practically the same in both lifts the results are strictly comparable The buckets were of iron with leather discharging trunks and were in good order and discharged an average of 28 gallons per bucket as measured into a tank The trial lasted 3 hours and in that time 200 buckets of water were raised The mean lift was 22 125 feet and the useful work done per hour was 413 000 ft lb The circumference *of the drum of the whim was 12 feet 11½ inches and the circumference* of the circle in which the bullock walked was 60 feet 9 inches, so that the velocity ratio was 4 67 The pull on the dynamometer at the ordinary speed of working was 90 lb and the pull to just prevent a full bucket descending 59 lb and the pull to just raise a full bucket 81 lb The mean between these last two quantities 70 lb is the force at the end of the lever arm required to balance a full bucket of water when friction is eliminated Multiplying by the mechanical advantage the unbalanced weight is 327 lb —a result probably not very much in error as the water in the bucket weighed about 300 lb The mechanical efficiency of the lift just moving is therefore 74 per cent and working at its normal speed 66 6 per cent The lifts averaged 1 111 per minute and the animal was therefore usefully employed for 52 5 per cent of the time and the absolute efficiency of the lift as a machine for utilizing the energy of the bullock is 0 6[illegible] × 52 5 or 35 per cent

Summary of the results —To facilitate comparison the results given above are collected in the table below —

TABLE III

	Mr Stoney's water lift	Double mhote Saidapet	M R Ry [illegible] Rao's improved [illegible]	M R Ry [illegible] Rao's new water lift
Useful work in ft lb per hour A	571 500	413 [illegible]	[illegible] 40	344 [illegible]10
Weight of animals lb B	1 14[illegible]	1 14	1 348	[illegible]00
$\frac{A}{B} = C$	498	[illegible]	3 1	492
Mechanical efficiency just moving	[illegible]3 6	[illegible]		[illegible]6[illegible]
Mechanical efficiency at working speed		[illegible]6	[illegible]	
Absolute efficiency	4[illegible]	3[illegible]		

Owing to the entire absence of leakage and the superior design of all the mechanical details Mr Stoney's water lift has the highest mechanical efficiency and the highest absolute efficiency The simple arrangement by which the bullock is yoked to the lever arm which is also used

materially greater, but it was a point the Committee were unable to decide as no larger buckets were available It is not likely that any great improvement can be made in the design of the lift, though prolonged experience of it at work will reveal the weak points, and the details can be simplified The framing supporting the buckets was in the lift at Saidapet unnecessarily complex, and Mr Stoney has prepared designs of very much simpler forms of framing which can be used for lifts permanently erected over any well The buckets might probably be made a little lighter, and the lip which comes in contact with the tilting bar requires thickening to prevent the burning of the edge which at present takes p'
single lever arm there is a cei
spindle which carries the drum
the wooden post and spindle are scarcely stout enough The arrangement for adjusting the length of rope to the depth of water in the well is very neat and simple From a ryot's point of view, the use of a number of nuts and bolts is an objection which is likely to be urged, but which may be
size of nut and bo
buckets also requir
though the extra
ing them, so that
probably show th
satisfactorily if the equilibrium is a little more stable The tendency to spill just as the bucket comes out of the water will then be diminished and the work on the guide wires to keep the buckets steady will be less By making the ratio of the diameter to the depth of the bucket greater, the effort required to tilt them would diminish and they would discharge even faster than they do now, but experience with buckets of different proportions will alone show whether any appreciable improvement can be effected in this direction The guide wires render it practicable to employ iron buckets in rocky wells, as there is no fear of the bucket being damaged against the side of the well, and by covering the bottom of the well with a foot of sand or by placing a sand bag at the bottom of the well, the danger of the buckets being destroyed by rough usage is greatly decreased From a mechanical point of view the whim would be improved by the introduction of an automatic reversing motion to obviate the necessity of turning the animals at the end

of each lift, but it would not compensate the ryot for the extra cost and extra complication this change would involve The whim can only be satisfactorily worked by a single bullock, as the diameter of the circle in which they walk is so small that with two animals the inside one always works at a great disadvantage, and to increase the length of the lever arm is to introduce other disadvantages The power of the animal is entirely utilized through his ability to exert a draught, and it is a well-known fact that walking straight forward the power to draw is considerably greater than when walking in a circle It is commonly assumed that the pull exerted by a horse walking round a circle of 25 feet diameter is only 60 per cent of that which he can exert when walking in a straight line, but the data from which this result was deduced are not available Probably with bullocks the loss of power does not exceed 20 per cent, as they are smaller animals with shorter legs, but though uncertainty may exist as to the amount of the loss, there is no doubt that there is a loss and that it is a disadvantage inherent in all water-lifts which employ whims

The single mhote, although very largely employed, is a very inefficient machine, and its prolonged working involves a very great strain on the cattle The simplicity of the machine however compensates for its inefficiency, and the merit of M R Ry Subba Rao's improvements chiefly lies in the fact that, without introducing any expensive or complicated additions, he has balanced the weight of the empty bucket and rendered it possible to turn the bullocks at the end of each run so that they may walk up the incline in a more comfortable and expeditious [illegible] olved can be [illegible] if it becomes

M R Ry Subba Rao's see saw or oscillating water lift can be worked with any type of bucket, and it was undoubtedly not being worked to advantage when tried by the Committee as the bucket was an iron one of the old fashioned mhote type and was not nearly as large as it might have been The design was far from perfect and the mechanical efficiency was very low yet the constant C obtained by dividing the useful work done in ft-lb per hour by the weight of the animal is nearly as high as for Mr Stoney's water-lift With a better type of bucket and one of larger capacity the constant would certainly have been much higher In its present condition it would be useless to criticize the details of the lift which requires to be put into the hands of a good mechanical engineer to bring out the many merits which this method of applying animal power to the performance of useful work possesses The animal does work by raising his own weight against the action of gravity and without going into a lengthy discussion of the various methods of getting work out of animals, it may be asserted without fear of contradiction, that an animal can do more work in a given time with the same amount of exertion when that work consists in storing potential energy in his own body than in any other way The difficulty is to devise a simple and cheap means, whereby that potential energy can be converted into useful work, and it would appear that

M R Ry Subba Rao has probably arrived at a practical solution of the problem In principle, the working of the lift in no way differs from that of the picottah, and not one of the least of the advantages which it possesses is that it is capable of being worked by coolies and in a very efficient manner should cattle from any cause not be available to work it With every water-lift there must be a man employed to drive the bullocks and in other forms of motor, this work, whatever it may amount to, is wasted but in this form of motor, the work done by the man is usefully employed It is partly due to this that the constant C has such a high value Below are given two equations showing the forces acting on the platform when it is in horizontal equilibrium (1) when the bucket is empty and the animal is at the free end (2) when the bucket is full and the animal is at the working end No account is taken of the friction which necessarily exists and which will consequently diminish the quantity of water which can be lifted by an animal of a certain weight —

Let x = length of long arm of platform
x^1 = distance of centre of gravity of bullock from fulcrum along long arm
y = length of short arm of platform
y^1 = distance of centre of gravity of bullock from fulcrum along short arm
W_1 = weight of long arm
W_2 = weight of short arm
A_1 = weight of bucket when empty
A_2 = weight of the water when the bucket is full
B = weight of bullock
V = velocity ratio of windlass

Then when the bucket is empty—

$$(1)\quad W_1\left(\frac{x}{2}\right) = W_2\left(\frac{y}{2}\right) + By^1 + VA_1 x$$

$$(2)\quad W_1\left(\frac{x}{2}\right) + Bx^1 = W_2\left(\frac{y}{2}\right) + (A_1 + A_2)Vx$$

Subtracting (1) from (2) we get

$$B(x^1 + y^1) = VA_2 x,$$

$$\text{that is } A_2, = \frac{B}{V}\left(\frac{x^1 + y^1}{x}\right)$$

[illegible]

should be equal to $\frac{B}{V}\left(\frac{x^1 + y^1}{x}\right)$ multiplied by a coefficient which will be less than unity in proportion to the percentage of power wasted in friction In the lift designed by M R Ry Subba Rao, the preponderance of the working arm was not sufficient, as it required only 362 lb at the free end to cause it to ascend, whilst it required 584 lb at the working end to set it in downward motion The bullock and the man working the platform cannot, of course, put their whole weight on the extreme ends of the platform, but it is possible for their centres of gravity to

Water-Lifts (A Chatterton)

Agricultural Implements

approach within 2 feet of the ends which would make the values of $x^1 + y^1$, 13 feet and 7 feet respectively and the value of $\frac{B}{V}\left(\frac{x^1 + y^1}{x}\right)$ with a bullock weighing 700 lb and a man 117 lb would be 415 lb equal to 44½ gallons of water Allowing for obliquity of action at the beginning of each oscillation and for friction by the use of a coefficient of 0 75, which, with a properly-designed lift should be attainable the quantity of water lifted might reach 33 gallons whereas it was only 23 5 gallons With a heavier load the lift would have worked better, and though possibly the time of ascent of the bucket from the well would be slightly longer the effect on the total number of lifts per hour would be almost inappreciable as the time efficiency of this lift depends mainly on the turning of the bullock at the ends

A question of some importance in connection with this oscillating platform is the gradient which it assumes when in the extreme posi [illegible] was 24 feet and [illegible] slope which the [illegible] ig platform the period of oscillation will be slow and it will therefore work more steadily than with a short platform the gradient will be less and the animal will be able to ascend it easily, but the greater the length, the heavier the platform becomes and the more expensive it will be There will be some particular gradient on which the animal can do most work which can only be determined by experiment, and as this will be largely influenced by the nature of the surface the animal has to walk on, attention should be directed to this point In the matter of gradient the lift at the Luz appeared to be satisfactory, but the nature of the foot hold seemed to leave room for improvement

The initial cost of setting up a water lift is a point of supreme importance to the ryot, and in this respect the improved water lifts submitted to the Committee compare unfavourably with those in use at the present time This is a difficulty which cannot be got over, and if the ryot wants and there is no doubt that in many districts he does a better machine for lifting water from wells he will have to face a greater capital outlay During the greater part of the irrigation season there are, in many places, a large number of unemployed cattle available for working water-lifts and in such places the introduction of improved water-lifts is likely to make slow progress but where more water is wanted than can be obtained by existing methods experience of sugar mills and iron ploughs shows that the ryot is not slow to adopt an innovation if he finds that he really benefits thereby Between the two water-lifts submitted to the Committee there is not likely to be any great difference in price but what difference there is will probably be found to be in favour of Mr Stoney's invention Next to initial outlay comes the question of maintenance and repairs and on this point it is, without prolonged experience of their working, difficult to express any decided opinion To erect them and keep them in working order requires more skill than is usually available in the villages and they can only come into extensive use by improving the skill of the ordinary

country blacksmiths To do this will no doubt be a far from easy task, but it is one that might well be taken up by the technical side of the Educational Department If a demand for skilled fitters and smiths arises, it should be possible for the various technical and industrial schools in the Presidency to meet it.

MADRAS,
21st August 1895

(Signed) A CHATTERTON, B Sc

ADDENDUM

Since writing the above report I have been informed by Mr W Keess, the Principal of the Agricultural College Saidapet that the assumption, that the amount of work [illegible] approximately proportional to their [illegible] accepted by agricultural authorities [illegible] animals, working steadily an average of 8 hours a day, can do 2 foot-tons of work per pound of their weight per day It must of course be clearly understood, that such work is entirely external and is not part of the energy expended in the muscular action In table III of the report, a summary of the experimental results is given from which it is easy to calculate the number of foot-tons of work done per pound weight of the animals employed in working the four lifts upon which experiments were made This calculation has been made with the following result —

	Foot tons of work per lb weight
Mr Stoney s water lift	2 253
Double mhote at Saidapet	1 930
M R Ry Subba Rao's improved single mhote	3 871 or 2 323
M R Ry Subba Rao s see saw water lift	3 511

In the first two cases the lifts are worked by pure draught on a horizontal plane and the result shows that the animals were doing about the work they ought to in the third case the draught is down an inclined plane and the number of foot tons of work done by the bullocks includes that due to raising themselves vertically through a height equal to that which they descended down the plane and is consequently much greater, but, if only the work done on the rope be taken into account, the foot-tons of work per pound weight would be reduced to 2 323 In the fourth case the animal exerts no draught whatever and simply does work by walking up an inclined plane, and in consequence much of the energy expended in muscular action becomes available and the amount of work done per pound weight is greatly increased

Examining the results in this way the conclusion is confirmed that the most efficient way of utilizing animal power is to make the animal raise himself against the action of gravity and then in some way, such as that adopted by M R Ry Subba Rao convert the potential energy stored in the animal's body into work The disadvantages of this method are purely mechanical and due to the necessarily cumbrous apparatus which must be used

MADRAS,
17th January 1896

A C

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr George Watt, Reporter on Economic Products to the Government of India, Calcutta

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions Contributions or corrections and additions will therefore be most welcome

In order to preserve a necessary relation to the various Departments of Government contributions will be classified and numbered under certain series Thus for example papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry under the Forest Series, and those of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series

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